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Anthology of K-12 Action Research Papers

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WILL LISTENING TO DIFFERENT GENRES OF MUSIC IN THE
LEARNING ENVIRONMENT DECREASE THE LEVELS OF STRESS
FOR STUDENTS?

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Will listening to different genres of music in the learning environment decrease the
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The final copy of the capstone has been examined by the signatories, and we find that
both the content and the form meet acceptable presentation standards of scholarly
work in the above mentioned discipline.

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Will listening to different genres of music in the learning environment decrease the levels of stress for students?

Capstone directed by Dr. Thomas Sherman

Abstract

There must be a way to control student's emotions through the use of music during lab time. If a student's stress level is decreased they should show an increase in enjoyment, good behavior and a sense of pride in work accomplished.

Four high school AutoCAD classes were selected for this project. Students came to class and listened to country, easy listening, rock, a mixture, or no music. The students were given a chart to fill out at the end of each day. On this chart they ranked how frustrated, concentrated, relaxed, energetic, and confused they were. The students were told this chart would be used so the instructor could see how well the lessons in the class were going. This way they would have no idea the charts were related to the music in any way.

Many studies have proven easy listening music improves learning. The results of this study were different because the classes used in this study did not simply memorize facts and figures; they used spatial skills to make shapes on the computer. The survey results showed *easy listening* music scored the second lowest and *no music* scored the lowest. *Rock music* finished first and the *mixture* section scored a close second. The results also showed, on average, any music gave better results than no music at all.

The significance of this study shows that to achieve a low level of stress in the classroom, the opportunity to listen to music should be provided.

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Will listening to different genres of music in the learning environment decrease the levels of stress for students?

CHAPTER ONE

Introduction

The school where this study took place is a growing school district in southern Minnesota. The increase in student enrollment has resulted in higher class sizes and has created many space issues. The school has the funds to hire more teachers to lower class sizes but there is nowhere for them to have class. This makes classes, like the one used in this study, difficult because there is a need for a lot of one-on-one between the teacher and the students. However, this has opened up the opportunity for more peer-to-peer teaching. Studies have shown that the average person retains 90% of what they teach so when a peer helps another they are also increasing their retention of that task. (Finkel, 2004)

The class that was used in this study is an AutoCAD class. This class is set up so the students get some direction at the beginning of the class and the rest of the time is used to get the assignments done. There is no reading or memorizing of facts. They are either doing mechanical or architectural drafting on the computer. Because of this, music has been used during similar classes at the college level such as the University of Wisconsin-Stout and Rochester Community and Technical College in Minnesota.

Need for the Study

Stress can be physically harmful as well as mentally harmful when methods of control are lacking. (WebMD, 2005) Learning and performing at peak performance cannot be done under heavy amounts of stress. (WebMD, 2005)

As an educator, the teacher strives to create an atmosphere where the student can relax and concentrate on the task at hand. Stress occurs when you perceive a situation as threatening. This is why a teacher would prefer to have a classroom where the student feels safe and away from negative stressors that occur in life.

Students are under severe amounts of stress whether it's at home, school, work, or during extracurricular activities. If a student is worried or stressed about something outside the classroom they are not going to be able to live up to their full potential. Their mind will wonder off task and will cause them to underachieve. When a student comes into the classroom relaxed but focused they get more accomplished and retain more information than someone under a lot of stress. However, "people perceive and respond to stress in different ways." "Some people seem to stand up to or bounce back from stress better than others." (WebMD, 2005) "Recent research demonstrates that 90% of illness is stress-related." (WebMD, 2005) If a student becomes ill they will not be able to attend the class. Other physical problems have been proven to be stress related besides becoming ill. Sleep disturbances, tension headaches, neck pains, irritability, memory problems, lack of concentration, and trouble thinking clearly are a few examples of stress related problems.

These stresses can come from unpredictable events, work itself, family, or the environment in which you live or work. A teacher has the ability to control some of these triggers to stress; therefore a teacher has the power to help control most stress related problems.

Statement of the Problem

Frustration and relaxation is an issue in student's everyday life. With the added pressures from parents, coaches, peers, and teachers; getting students to calm down and get focused on the task at hand becomes increasingly difficult everyday. The stress becomes very unhealthy with everything a student can be involved in. Coming into class uptight and frustrated at other things carries over into the classroom. The feelings get pawned so someone or something feels the need to relax. It is not healthy to hold these feelings inside and not be able to let them roll off your back.

In a CAD class a student needs to be able to sit and concentrate at a computer screen for eighty-five minutes. This can prove to be a difficult task for someone who is calm and isn't confused with what is going on. So, for the student who is wound up and confused on the skills being learned, they are a time bomb waiting to go off. Finding ways to help them get in the relaxed mood and ready to tackle the difficulties of drafting on a computer is a positive thing for the student's health, behavior, and academics.

Purpose of the Study

The purpose of this study is to help students cope with everyday stress by using music as the medium as well as improving their ability to work in the classroom. Stress in a student's life can be controlled to help prevent them from becoming physically or mentally ill. Every emotion in the human body is strongly affected by music. (Music Therapy, 2005) There is no way to prevent stress but to understand what it is and have a way of partially controlling it would be very beneficial to anyone. Stress affects the student's ability to learn to their fullest potential. If music is a way of lowering their levels of frustration so they can concentrate in a lab setting on the task at hand then it should be used.

Statement of the Hypotheses

Will changing the learning environment from no music to various genres have an influence on the ability to learn? Comparing the different genres to one another will show which type lowers stress levels the most. By listening to different genres of music during lab time, students in AutoCAD will decrease their levels of stress, which will positively affect their ability to learn.

Definition of Terms

To clarify any ambiguity of terms, these definitions are given.

Drafting: Any type of drawing

Architectural Drafting: Drawings of residential and commercial buildings

Mechanical Drafting: Any drawing done that is not architectural

AutoCAD: (Computer Aided Drafting) With the aid of a computer and a drafting program drawings are created on the computer

Rock Music: This was a combination between classic rock music and modern rock music used during the study.

Easy Listening: This was a combination of slow jazz and classical music used during the study.

Country: This was mostly modern country music used during the study.

Mixture: This was a combination of the best songs from all three area's used during this study.

Variables

Independent variables

Listening to different genres of music and no music in AutoCAD during lab time.

Dependent variables

The frustration, relaxation, energy level, confusion, and concentration levels of the students during lab time.

Control variables

All students in the study were high school students from the same high school. They all sit at the same type of computer and in the same spot everyday.

Moderator variables

Time of day and what happens outside of the classroom. Where the students sit will be a factor because some will be closer to the speakers than others.

Limitations and Delimitations of the Study

All of the students in this study were high school students at the same school district during the 2004-2005 school year. They all have the same AutoCAD teacher with the same expectations, rules, projects and assignments. AutoCAD class is an eighty-five minute class every day for nine weeks, so time is limited for everyone. Classes were at different times of the day so their emotions could vary based on morning or afternoon. The days where one class would listen to music didn't always coincide with the other class. The number of students in each class, between sixteen and twenty-five students, varied as well.

The factors differ in each student. There are diverse levels of appreciation and ability in AutoCAD and music for these students. Some students come from affluent homes while others are living near the poverty level; some students are needy academically and emotionally. There are students from single parent homes and students from two-parent homes. A significant factor in this study is the level of exposure to music and the genres each student has been brought up listening too. Many students got frustrated at the types of music the researcher would play. When a student chose a type of genre the class as a whole never totally agreed with the decision. The need for assigned seats made the volume of the music an issue as well.

Some further away wanted it louder whereas the students sitting next to the speakers wanted it softer.

CHAPTER TWO

Review of Related Literature:

Stress vs Health

There are four undisputed facts about stress. Stress has been around since man first walked the earth, everyone has differentiating abilities on how they handle it, some is good, but like almost everything too much of it can be deadly. Everyone has some type of stress or another, whether someone is worried about getting food on the table or worried about not having matching earrings to go with her dress. Stress is a disease that everyone has, but given the proper knowledge can learn to live with it. Some handle stress very well and they are able to let it slide off them like half melted ice cream off a spoon. Others allow it to consume their every thought until physical damage is done to their body. "Stress can be both helpful and harmful. The stress response gives us the strength and speed to ward off or flee from an impending threat. But when it persists, stress can put us at risk for obesity, heart disease, cancer, and a variety of other illnesses." (Block, 2001)

The more a person is stressed the easier it is to become stressed later in life. "The experience of stress in the past magnifies your reactivity to stress in the future. So, take a nice deep breath and find a stress-stopping routine this instant." (Carpi, 1996) Music could be a way of controlling this stress to help suppress it in the future.

Some stress can be very helpful. It can be the push someone needs to go the extra mile and get a project done. If there was no stress of a deadline it may never have gotten done. "But in our modern society, stress doesn't always let up. Stress

hormones continue to wash through the system in high levels, never leaving the blood and tissues. And so, the stress response that once gave ancient people the speed and endurance to escape life-threatening dangers runs constantly in many modern people and never shuts down.”(Block, 2001) However, stress is mental but it involves real chemicals in the brain. If there is constant stress with virtually no relief these chemicals can cause a number of physical and mental illnesses.

“When a stressful situation ends, hormonal signals switch off the stress response and the body returns to normal.” Stress can hinder the reproductive system, growth, gastrointestinal tract, cardiovascular disease, muscle pain, asthma, skin problems, and immune system problems. Short term symptoms of stress can be sleep disturbances, migraine headaches, upset stomach, cramps, diarrhea, weight gain or loss, hair loss, fatigue, chest pains, sweaty palms, cold hands, and skin problems. Stress can produce constant anxiety, loss of appetite, loss of sex drive, rapid heart beat, high blood pressure, and also can cause depression.” (Block, 2001)

Music Therapy

Listening to the right type of music can do wonders to alleviate stress. Music is soothing to the listener and can calm down the most frustrated student. “Music is a significant mood-changer and reliever of stress, working on many levels at once.” “The entire human energetic system is extremely influenced by sounds. (Music Therapy, 2005) Thanks to mp3 players, wireless music routers, satellite radio, the ever-growing popularity of music on cell phones, and the ease of downloading music onto computers music can be listened to whenever time allows. Music’s ubiquity and increasing portability make it the number one stress buster.” “When you think of music’s cost and its availability via radio it’s not surprising that more than half the world listens to music to relax.”(Reuters, 1999) “Music can be used to activate, stimulate and relax the mind and body. More and more businesses are recognizing the importance of music in a work environment.” (Wohlfarth, n.d.)

Unwanted sounds in the workplace can be distracting especially in a school setting. There are always questions being asked, noise in the hall, and in the CAD classroom there are noisy computers. “Even at low levels, unwanted sounds can constitute health and safety hazards by increasing stress levels, and impairing communication and concentration.” (Canada Safety Council, 2002)

Music has also been proven to help physically relax the body too. “(Music) provides a predictable and secure environment, induces feelings of well being, decreases physical responses such as heart rate and respiration, induces and maintains relaxation once it occurs, brings order to chaotic situations, provides a break from frenetic activities.” (Pfeffer, 2005) Not only does this help maintain a healthy living, it also has proven to help with pain and quicken the healing process. “Patients who are soothed by music and words of comfort during surgery have less pain and fatigue during their recovery.” (Pfeffer, 2005) There have been other studies that prove easy listening music is more relaxing than rock music. One study concluded, “From a psychological evaluation, we found that classical (easy listening) music tends to cause comfort. This is because the nerves are suppressed by the sound of classical (easy listening) music.” (Engelgau, 2005)

Stress Motivation

Stress can be harmful but it can also be motivation to help you get a goal accomplished. “As the individual is motivated to perform a task at a certain level of proficiency, the term stress is used. Ruch suggests that individual differences are very important in the way a subject reacts to stress.”(Sherman, 1980) Some individuals need the pressure of stress to reach a goal, but for others it can cause an unwanted

block. This block can prevent an individual from doing their best work. “Under stress, some individuals do better and others do worse.” (Sherman, 1980) The stress of getting a task done on time can lead to increased time in getting the task accomplished. “On the other end of arousal is frustration, which increases the amount of time that it takes to learn a task. Castaneda and Lipsitt found that frustration has less effect on the learning of the task if learning is in the late stages.” (Sherman, 1980) There are ways to help control stress if it is a problem for someone. “Motivation and awareness, before stress is experienced, help to determine the effect that the stress will have on the individual.” (Sherman, 1980)

Music and Knowledge

There have been other studies done that support the fact that incorporating music in the curriculum increases other aspects of education. A study done by Christof Pantex, Germany “suggests that musical training makes the cortical map of the brain grow. When music is added to the school curriculum, mathematical skills will increase.” (Fender, 2006) Even just listening, humming, or singing music can “activate all four of the cortex’s lobes; and that parts of the cerebellum are also activated.” (Fender, 2006) Students who listen to music and have a musical background tend to do better academically. “Recent studies have shown that music students do better in school than their nonmusical counterparts. In 2000, music students scored an average of 93 points higher on the SAT, according to the College Entrance Examination board.” (Hanafy, 2004)

Music and Spatial Skills

A student who is successful in an AutoCAD class needs to have good spatial skills. They need to be able to look at a 2D drawing and think of it in 3D. They need to be able to picture, in their mind, how shapes are going to form on the computer so it makes sense to them. “A University of California study showed that after eight months of keyboard lessons, preschoolers showed a 46% boost in their spatial reasoning IQ.” (MENC, 2002) and (Hanafy, 2004) Another study of a Kindergarten class in the Kettle Moraine, WI school district scored 48% higher on spatial-temporal skill tests if they were given music instruction compared to those who did not receive music training. (MENC, 2002) “Studying music can make children smarter. Evidence shows a correlation between music education and better results on measures of spatial intelligence.” (National Coalition for Music Education) *The American Music Conference* in 2001 reported “music...improves “spatial-temporal reasoning”” (Fender, 2006) The Neurological Research Department at the University of California Irvine did a study which concluded, after six months of keyboard lessons, those children who received piano training performed 34% higher on tests measuring spatial-temporal ability than the kids who received no training. (Fender, 2006)

Studies have also shown that listening to music is critical in developing spatial skills. “The effect of music instruction on spatial skills. Music instruction can supply intellectual, emotional, and physical components critical to children’s development. During the last ten years, investigators have suggested that music instruction may have an effect on spatial skills or the ability to visualize an object from different perspectives.” (Persellin, n.d.)

Music and Creativity

Being creative and able to think outside of the box assists students in their CAD drawings. Part of the class is dealing with designing their own house and they are graded on their creativity as well as their accuracy. John Sculley, the former Chairman.CEO, of Apple Computers was quoted as saying;

“As a chief executive of a technology company that thrives on creativity, I want to work with people whose imaginations have been unleashed and who tackle problems as challenges rather than see them as obstacles. An education enriched by the creative arts should be considered essential for everyone.” (Fender, 2006)

CHAPTER THREE

Methods and Procedures:

Overview

This study was done in four high school AutoCAD classes. This is an elective class for grades 9-12 and is an hour and a half a day for nine weeks. The music selections were put into 5 categories; easy listening, country, rock, mixture, or no music. One of these categories was selected each day and played throughout the whole class period. The students gave feedback and filled out a survey at the end of every day. (Appendix A) The survey was made up of five categories, which were frustration, energy level, confusion, relaxation, and concentration. The student would circle a number between 1 and 10 depending on how they felt by the end of class. The students were told this survey was used to measure how the teacher's lesson went that day. For fear of skewing the results they were not told anything about the study being done. Only the surveys of the students who took the assignment seriously were used, so the final sample size was 27 students. Over 6000 pieces of data were recorded and averages were tabulated. The results were then compiled and the different genres were compared to days with no music. (Appendix B-G)

Design

This is an elective class so the students that are in the room chose to be there. This class is in a big computer lab with plenty of room for the instructor to move around and interact with the students. During the lab time, in this class, music is

played to make the experience more enjoyable for the students. They get to sit by whom they want but most of the time they work alone. Music can be a powerful tool but what type of music is best for the students learning?

This action research project will be a deciding factor in answering the question, *“Will listening to different genres of music in the learning environment decrease the levels of stress for students?”*

Selection of Subjects

The subjects were four CAD classes during the second and third quarter of 2004-2005. Each of the classes had similar number of students and they were all in the same classroom. Two of the classes started at 8:00 and met every day until 9:25 and the other two classes met from 11:35 to 1:00. They both listened to similar genres of music at the same volume level. This was the setup for quarters two and three of the scheduled school year.

Validity Measures

The students answered a survey of specific questions about themselves at the end of each CAD class regarding the following areas: frustration, energy level, confusion, relaxation, and concentration. They would circle a number 1-10 depending upon the level of each of these areas; 1 being the most unfavorable result and 10 being the best result. The researcher totaled the results and compiled the answers to get an accurate display of the student responses. They were told the results would be used to make the lessons better so they were asked to be very honest with their answers. The

researcher wanted to prevent the Hawthorne Effect. The Hawthorne Effect is when there are varying results because the students know they are being tested so they answer differently. To prevent this, the students were not told anything about the study or the music being played. Some students did not fill out the survey completely or would circle the same answers every day. These surveys were thrown out; therefore, this study is valid. A t-test was also performed and the outcome showed the results of this study are valid as well.

Reliability Measures

This study was dealing with nature and the human mind so this study was not reliable. However, if repeated, some of the same outcomes or patterns would most likely occur. Using new students, larger or smaller class sizes, different assignments, changed class times, or using different amounts of one genre of music would have unpredictable research findings.

Field Procedures

It was determined that the 9-12 grade CAD classes would be the classes to participate in this study. There were a large number of students to sample from in these classes as well. These classes have a lab setting where music can best affect the stress of the students.

The time frame was determined by the school year calendar, which divided the school year into four equal sections of which two quarters were to be used for this study.

Students documented their answers on surveys after each CAD class. All surveys were collected, recorded, totaled and compiled on the teacher's spreadsheet. The information was then studied and compared for accurate results.

Conclusion

The researcher of this study designed it with the question, “*Will listening to different genres of music in the learning environment decrease the levels of stress for students?*” The significance of this study is in order to achieve a high level of enjoyment, music should be used to create a stress friendly environment.

CHAPTER FOUR

Results and Discussion

The results of this study were partly as expected with a little surprise. The survey results showed, compared to days with no music, on average students who participated in this study did reveal an increase in their energy level and concentration in every category. It also showed a decrease, in every category, for confusion. The students were also more relaxed with every category but country music. Lastly, there was a decrease in frustration except on mixture and country days.

Procedures

This study was done in four high school AutoCAD classes. This is an elective class for grades 9-12, which is an hour and a half a day for nine weeks. The music selections were put into 5 categories; easy listening, country, rock, mixture, or no music. One of these categories was selected a day and played throughout the whole class period. The students gave feedback and filled out a survey at the end of every day. (Appendix A) The survey was made up of five categories, which were frustration, energy level, confusion, relaxation, and concentration. The students would circle a number between 1 and 10 depending on how they felt by the end of class. There is an example of one on the next page.

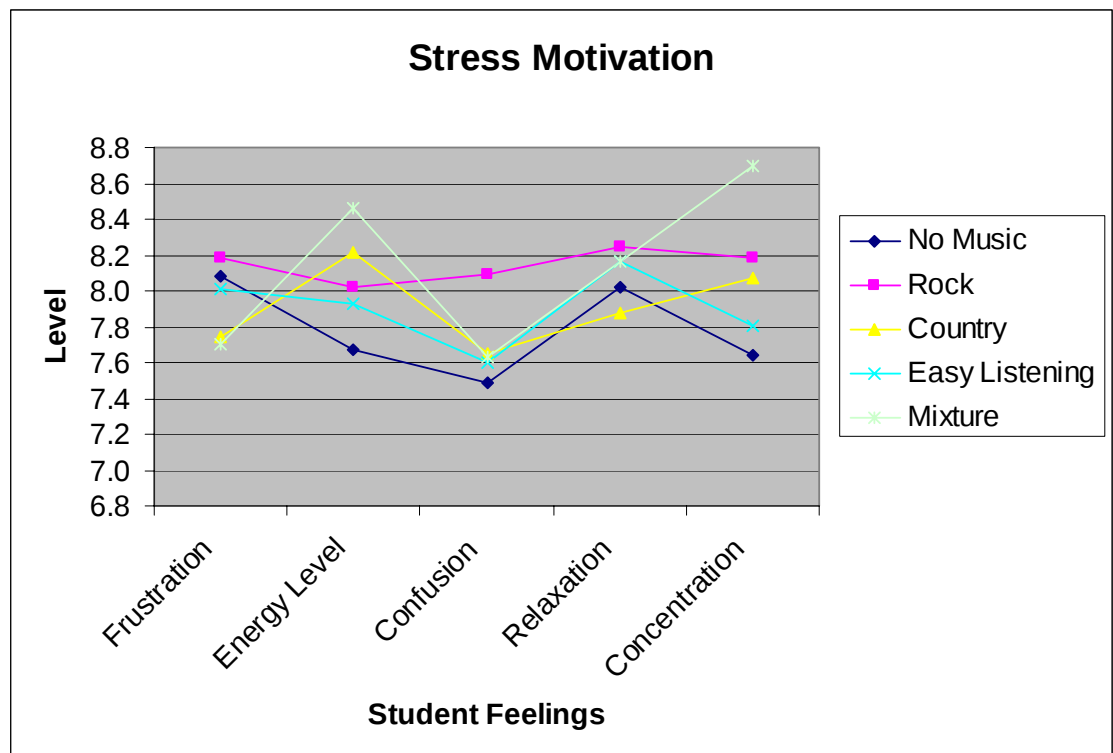
Example of Student Survey

Date	Frustration: 1 - very frustrated 10 - not frustrated	Energy Level: 1 - very tired 10 - very awake	Confusion: 1 - very conf. 10 - not confused	Relaxation: 1 - very tense 10 - very mellow	Concentration: 1 - not focused 10 - very focused
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10
	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10	6 7 8 9 10

All the below results are also illustrated on the graph on the bottom of each page. They are also illustrated individually in the Appendix.

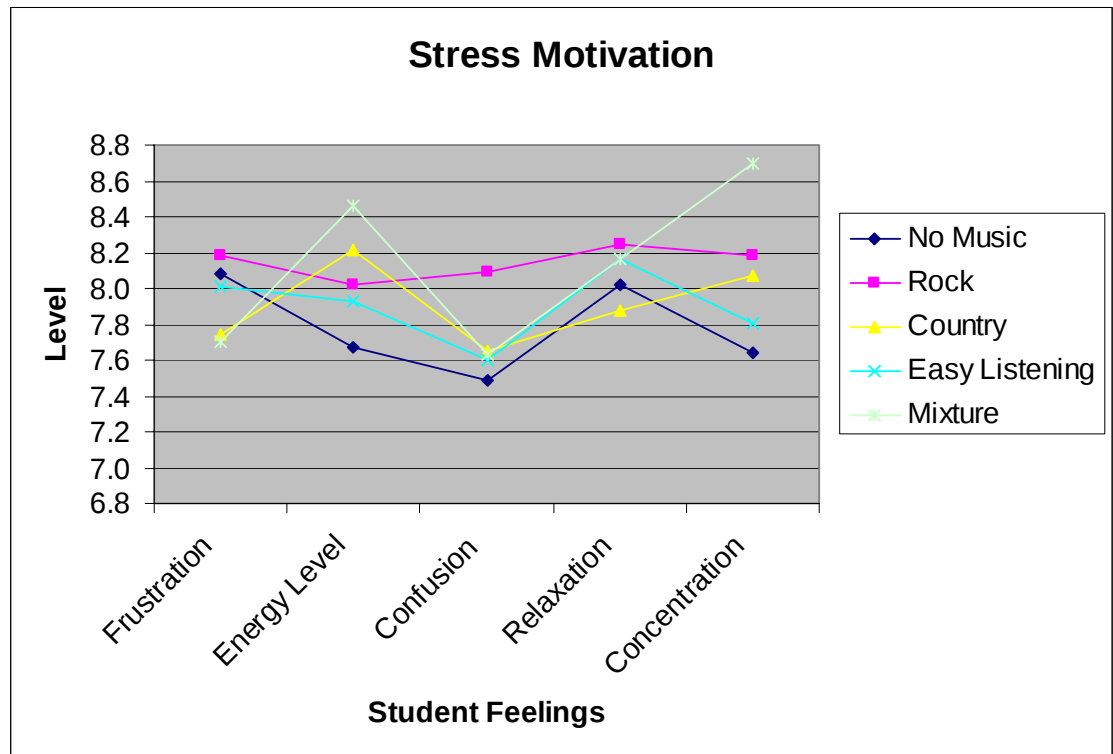
The first category, on the survey, was how frustrated the student was after class. The students recorded the least amount of frustration on the days rock music was being played. (Appendix B) The highest level of frustration was very close between country (Appendix C) and a mixture of music (Appendix E). Just from being in the room there was a sense that the students didn't like country so they became frustrated.

The second category was how was the student's energy level at the end of the class? The students recorded days with a mixture of music (Appendix E) gave them the most energy. The days where no music (Appendix F) was played they had the least amount of energy. Any day there was any type of music playing the energy level in the room was better.



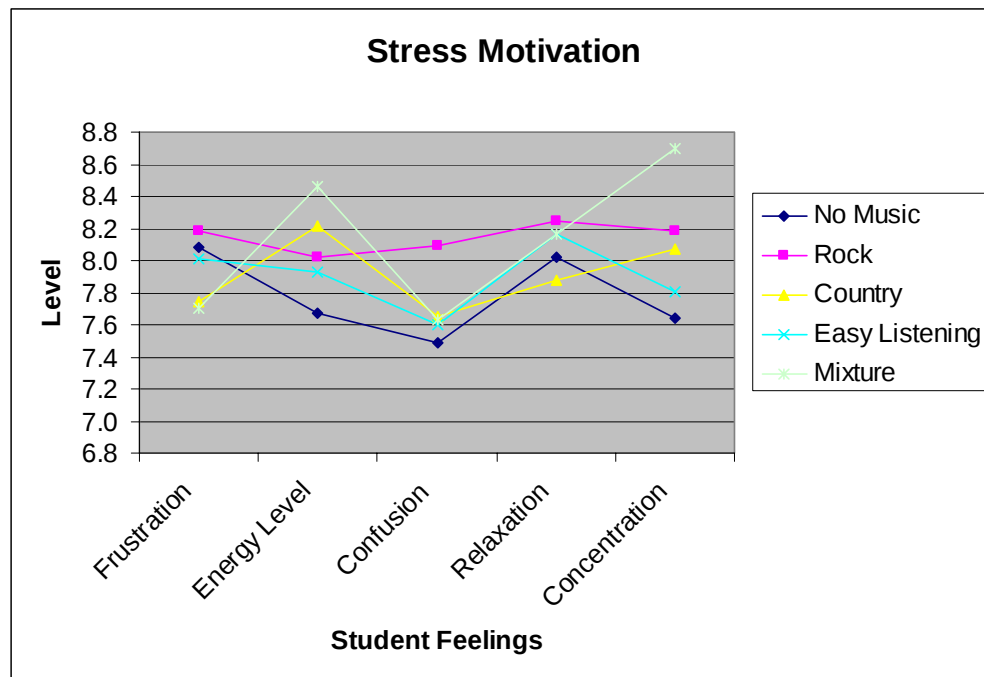
The third category was how confused the student was at the end of the day. As a class the students ranked days with rock music (Appendix B) playing as the days they are the least confused. They also ranked days with no music (Appendix F) playing as days when they are the most confused when compared to every other type of music. This shows that no matter what type of genre is being played the students show a decrease in confusion.

The fourth category was how relaxed the student was at the end of the day. The results showed that with rock music (Appendix B) playing throughout the day they were the most relaxed. It also showed that with country music (Appendix C) playing the students were the least relaxed. No music (Appendix F) playing placed 2nd to last so the results conclude that the students are more relaxed with all genres of music playing except country music.

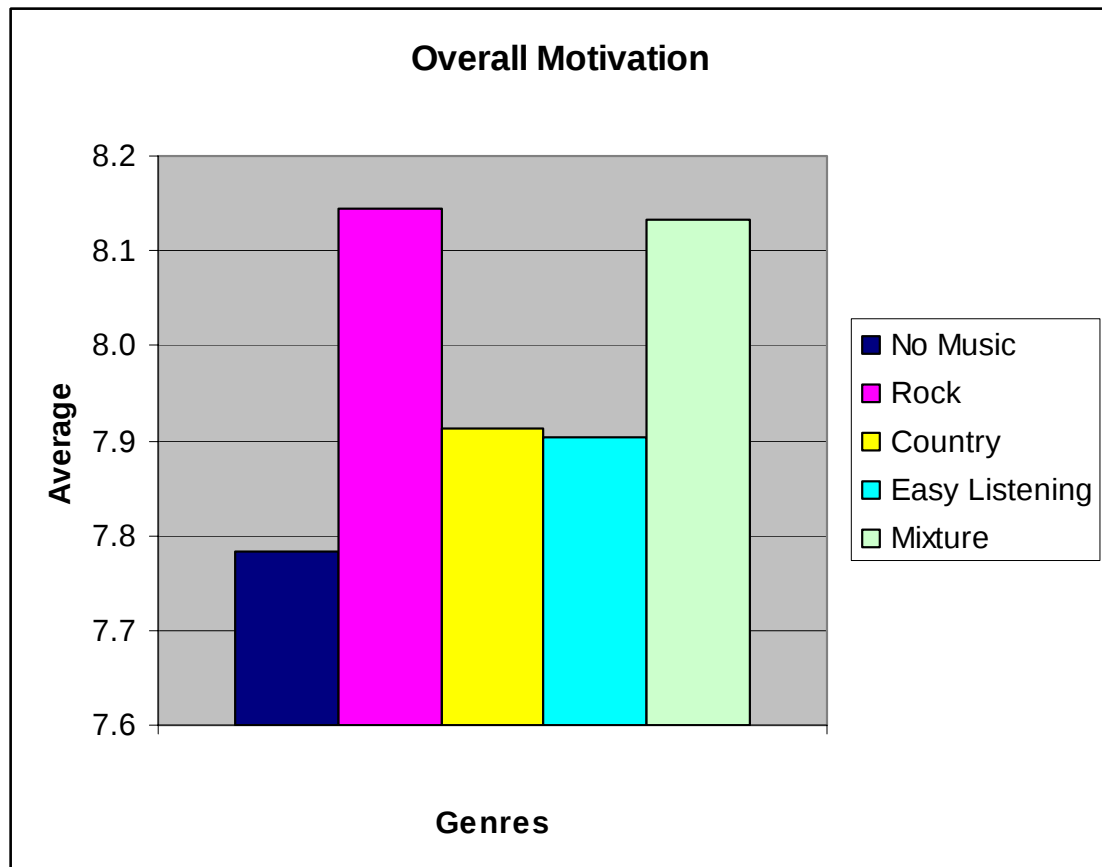


The fifth category was how concentrated the student was throughout class?

The results showed the days the class listened to a mixture of music (Appendix E) they were more concentrated. On days where no music (Appendix F) was played the students were the least concentrated. Rock music also scored high in this category as well. This concludes that students can concentrate, in a lab type situation, better with any type of genre of music playing.



On the chart below you can see if there were one type of genre of music to pick for maximum results it would be rock music with a mixture of music coming in a close 2nd. (Appendix G) However, any type of music would give you favorable results as opposed to no music at all. In this type of setting the results probably depend more upon what type of music you enjoy as opposed to what type of genre it is. This is why rock music scored the best because, as a whole, these kids probably enjoyed this type of music the most. When a mixture is played it appeals to all the students likes, therefore, scoring higher here too.



Variables

Student attitudes on the days they came to CAD class could have been a factor in how they answered questions on the survey. If students were not honest with their answers, or just chose an answer without reading the question, the results may have been different. Some students had little time to complete their surveys or did not care so it may have swayed the results one way or another.

The results of this survey may have been different if the students were able to play what type of music they wanted to and then compared the results to days with no music at all.

Hypothesis Testing

Student surveys were collected for data. This data was collected, charted and graphed.

CHAPTER FIVE

Summary and Conclusion

Listening to music should be available for students in a CAD class. It would be interesting to see if the students were allowed to listen to whatever type of music they want to, on headphones, if the results would be skewed even more. This type of study would be difficult with a high school class because it would be tough to monitor what everyone is listening too. They could be listening to something that is inappropriate for school or students their age to be listening to. However, this study still proved the benefits of music.

It also proved rock music to be the most affective type of music, used in this study, to lower stress levels of students in the classroom

Summary of Results

The results of this study show that music does relieve the overall stress of a student during class no matter what the genre is. It also showed that rock music was the best overall stress motivator and that easy listening music was the worst stress motivator out of the four genres of music used in this study.

Conclusions

The researcher feels this study was sound and effective. The study was backed by research from notable scientists and educators. The reliability measure would change if new students, assignments, or class times were dissimilar to this study.

Recommendations

Have the students rank each category of music from best to worst. This way you can compare the results to see if their preference in music correlates with their overall stress levels. Will listening to the type of music the class, as a whole, preferred create a more stress friendly classroom environment? “Music can...calm us or whip us into an emotional foot-stomping frenzy. Playing “our song” can trigger memories and nostalgic moods.” (VanDerWeele, 1992) Music can cause different students to react differently so maybe there are other options to benefit all students. If you could figure out a way to monitor what the students are listening to and you have access to enough headphones; it might be beneficial to let them listen to what they want to and compare those results to days with no music playing.

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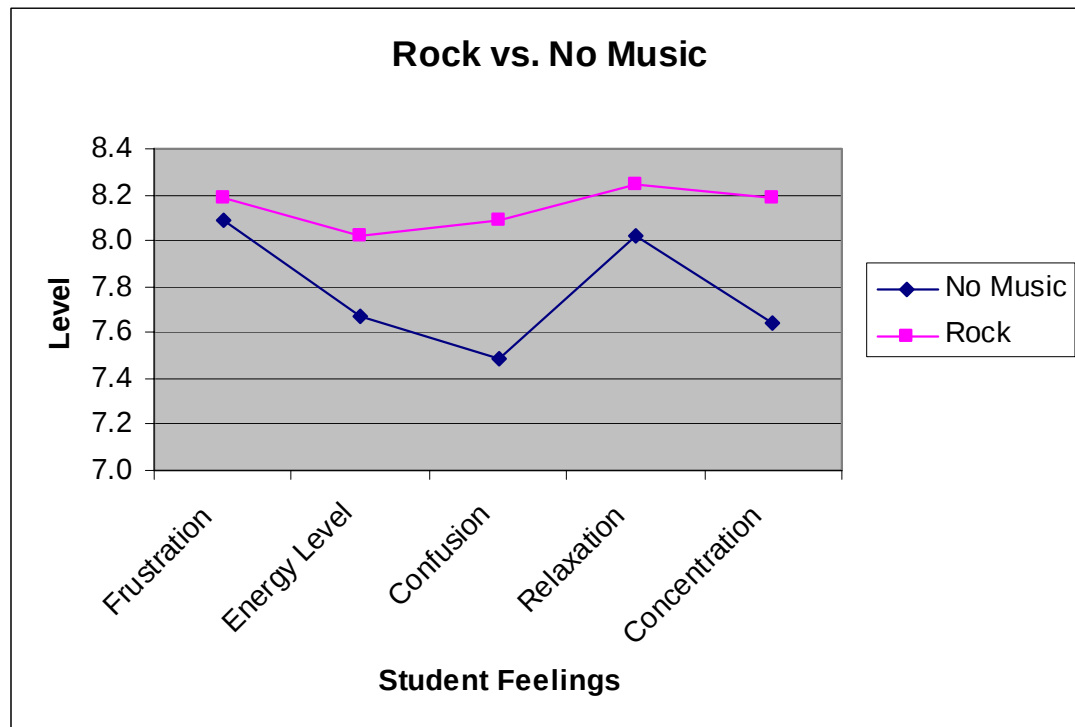
Appendix A

This is a sample of the compiled averages of the data collected for the days when No Music was played.

No Music	Frustration	Energy Level	Confusion	Relaxation	Concentration	Overall Feelings
Alex	6.8	7.2	5.6	7.6	9.4	7.3
Bob	8.4	9.0	8.2	7.8	9.2	8.5
Brett	9.7	9.2	8.7	9.8	9.7	9.4
Cody S	8.8	9.3	8.0	9.0	5.8	8.2
Jade	7.5	7.5	9.0	8.3	4.8	7.4
Jared P	9.0	8.6	8.6	9.2	9.2	8.9
Joe	8.0	7.0	6.2	8.8	4.0	6.8
Josh	9.2	9.8	8.2	10.0	8.3	9.1
Kayla	8.4	8.8	8.2	6.8	8.6	8.2
Kellen	7.2	6.8	6.6	7.2	7.4	7.0
Kirsten	9.7	8.8	7.0	7.7	8.0	8.2
Logan	6.4	7.4	4.8	8.4	6.4	6.7
Matt	7.2	5.2	8.3	6.3	6.2	6.6
Rich	7.8	9.0	7.3	9.0	8.2	8.3
Tony	8.7	9.4	8.3	8.8	10.0	9.0
Tyler L	8.2	8.2	7.8	7.8	8.4	8.1
Katie B	7.8	5.4	7.6	8.0	9.4	7.6
Coty S	7.3	8.3	8.7	7.5	7.5	7.8
Omar B	6.6	6.6	8.0	8.0	7.6	7.4
Rich G	7.0	8.6	7.2	7.2	6.5	7.3
Hector R	8.8	6.6	6.0	8.0	6.8	7.2
Jade M	9.2	7.4	8.2	8.6	7.6	8.2
Jared O	7.2	6.2	8.0	7.7	7.0	7.2
Ryan W	9.5	7.3	8.5	8.0	8.0	8.3
Adam B	6.0	6.6	5.2	6.4	4.8	5.8
Kellen R	9.2	4.8	7.2	6.0	8.0	7.0
Tyler H	9.0	8.4	6.8	8.8	9.6	8.5
Average	8.2	8.2	7.5	8.3	7.7	8.0

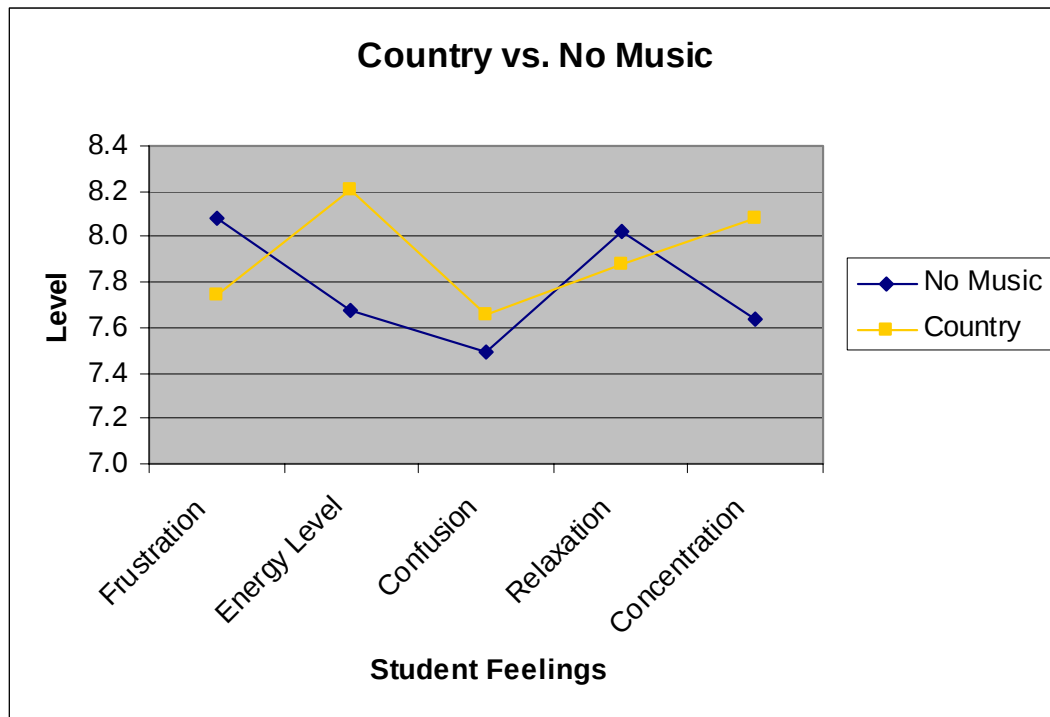
Appendix B

Comparing the Students Feelings on days when Rock music was played to days when No Music was played.



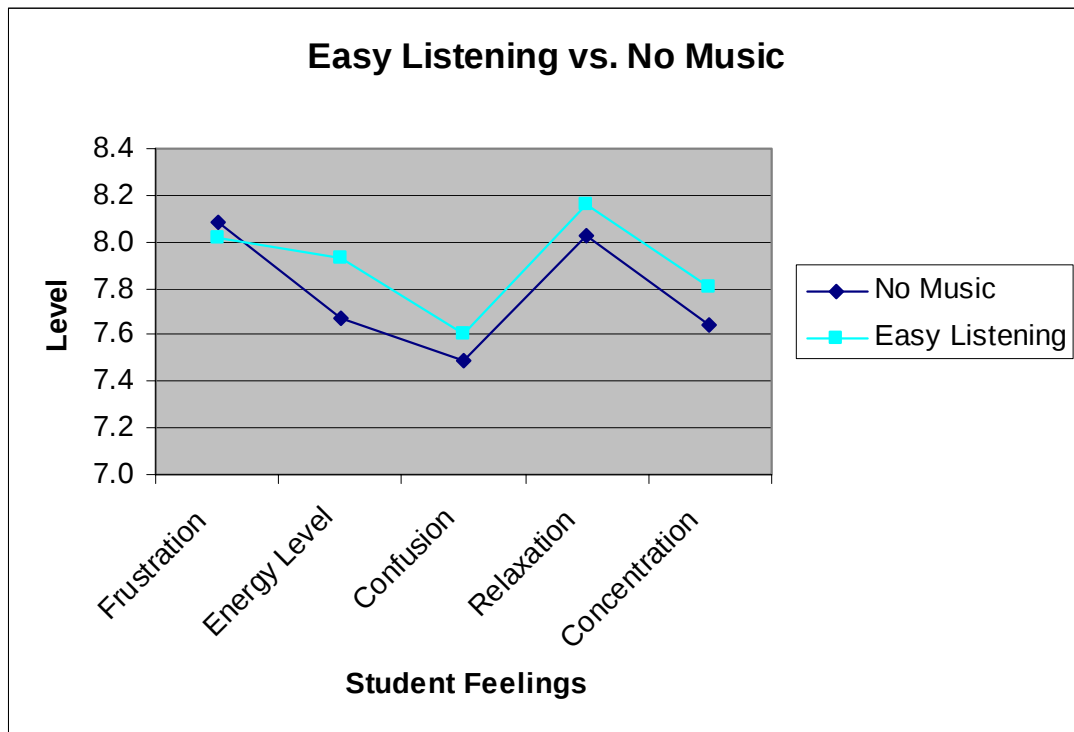
Appendix C

Comparing the Students Feelings on days when Country music was played to days when No Music was played.



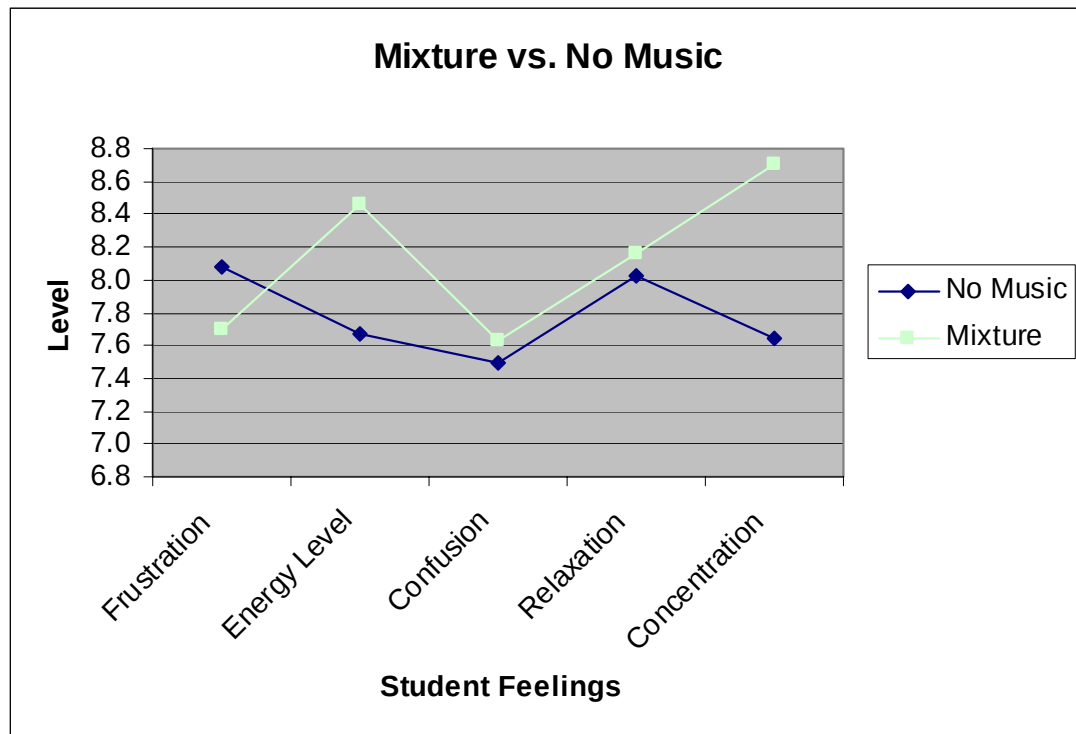
Appendix D

Comparing the Students Feelings on days when Easy Listening music was played to days when No Music was played.



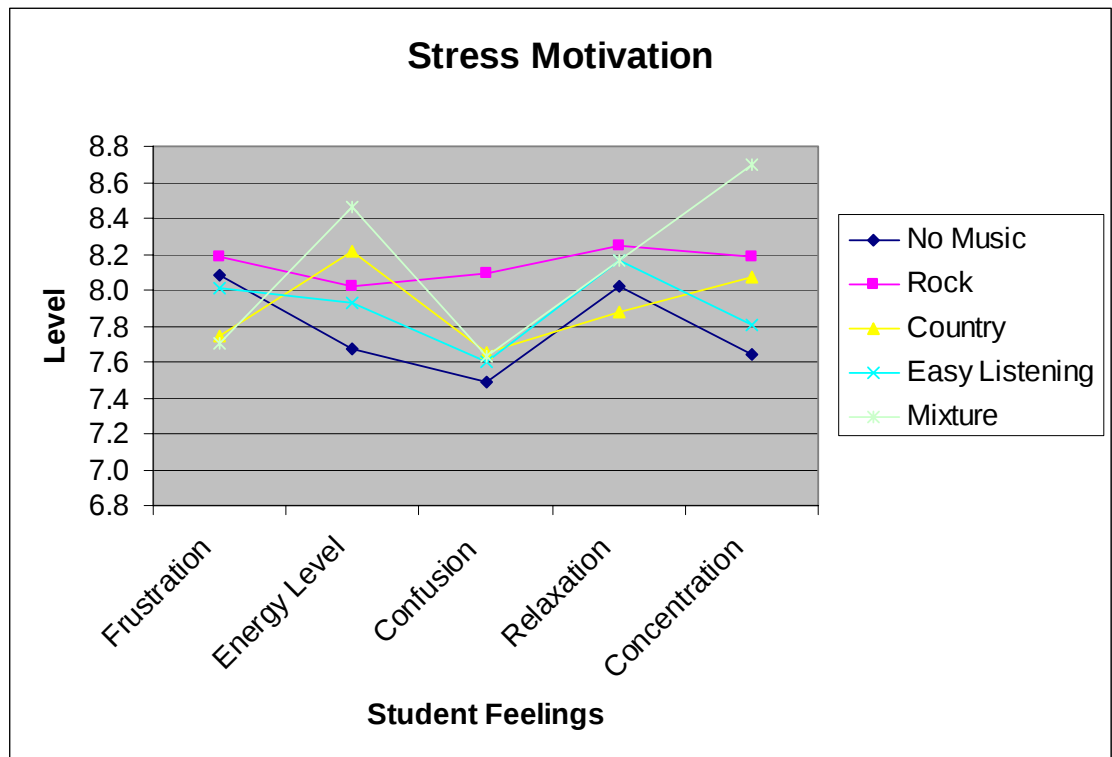
Appendix E

Comparing the Students Feelings on days when a Mixture of music was played to days when No Music was played.



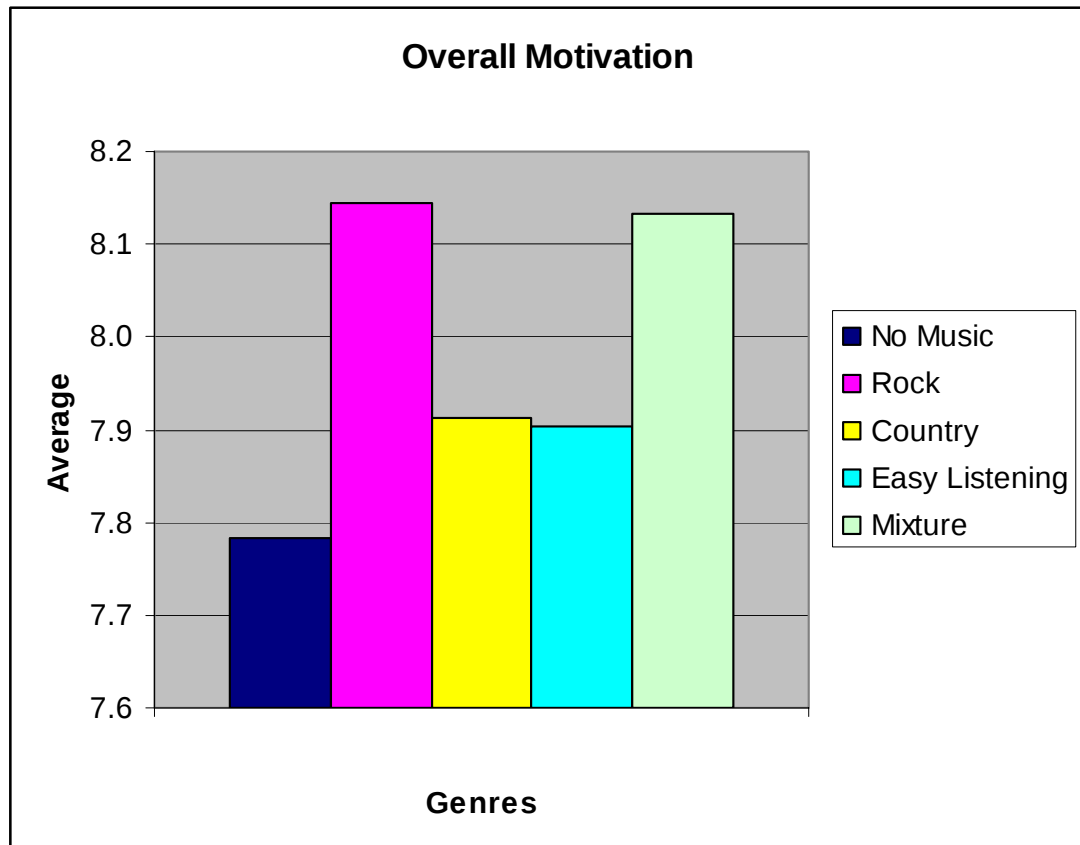
Appendix F

Comparing the Students Feelings to all genres of music and when No Music was played.



Appendix G

This compares the overall average feelings with the different genres of music played.



Will Maintaining A Vocabulary List In Social Studies Improve Writing Levels of High
School Seniors?

by

John Pittenger

B.S., Winona State University, 2000

B.S., University of Wisconsin-Lacrosse, 1998

An action research project submitted to the
Graduate School of Winona State University
in partial fulfillment of the requirement for the degree of

Master of Science

Department of Education

April 2004

This action research project entitled:

**Will Maintaining A Vocabulary List In Social Studies Improve Writing Levels of
High School Seniors?**

Written by John Pittenger
has been approved for the Department of Education

Chris Fernholz

Carrie Miller

Daniel Vrieze – Outside Resource

Dr. Tom Sherman

Date

The signatories have examined this project, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above-mentioned discipline.

Pittenger, John (BS, Secondary Education Social Studies, History)

Will Maintaining A Vocabulary List In Social Studies Improve Writing Levels of High School Seniors?

Research project under the direction of Dr. Thomas Sherman, Cheryl Moertel, and Heather Klees.

Abstract

Dover-Eyota High School is a predominantly white and English speaking school which underperforms on standardized test scores when compared nationally with similar students. This study was begun recognizing that development of English language skills is the responsibility of more than English teachers. This study researched was how social studies curriculum better enhance students' ability to use the English language. At the beginning of a semester-long course in recent American History, students were given a question and asked to give a written response. Their responses were then calculated to reveal the grade level at which they wrote. After seven weeks of class, students were given a similar writing prompt and scores taken once again. Over the following seven weeks, the students were then required to maintain a list of vocabulary they encountered in American History coursework that was new or unfamiliar to them. Students were to define the words, adding to their lists with at least 20 new words per week. The students increased their writing level over the first seven weeks by approximately one-third of one grade level. After the period in which students maintained vocabulary lists their improvement was almost twice that of the first period. The literature review of this study found extensive research that supported the need for enhanced English

skills to succeed in the American society. The research further showed effectiveness of similar techniques to improve vocabulary usage. The hypothesis of this research was that students who maintained vocabulary journals would increase the grade-level of their casual writing more than occurs in a control group. The students in the experimental group did in fact increase their writing level nearly twice that of the control, validating the hypothesis to an extent.

Acknowledgements

Research of this type and depth puts extensive demands
on those involved. I would like to extend heartfelt
thanks to my beautiful and brilliant wife Nicole, for
her encouragement, guidance, and patience.

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CHAPTER I: INTRODUCTION

I spent the first five years of my college education under the belief that I should be a history professor. I felt it my calling until I began to coach and work at a homeless shelter during college. These experiences brought me to a realization that I needed to combine my love of history with a chance to help young people through trying times.

This year marks my sixth year of teaching at Dover-Eyota Senior High School. I have been fortunate to be surrounded by an excellent staff and community during this time. This has been my first teaching job. The last five years I have taught the same classes each year. I am responsible for World Studies and Senior American Studies. Classes are 88 minutes long within a four period day. It was in this atmosphere that my twelfth graders that became the central focus of this study.

After teaching seniors for some time the topic of American College Testing scores came up and several students informed me of how proud they were of particular scores having beaten the national average. I suggested we compare them to students of a similar racial and regional group and check the results. With the help of a school counselor I was able to show them that the scores for which they bragged, were below average for caucasian students from Minnesota. (I have since sought ways for my class to not only teach social studies but also help to increase the academic rigor of our school)

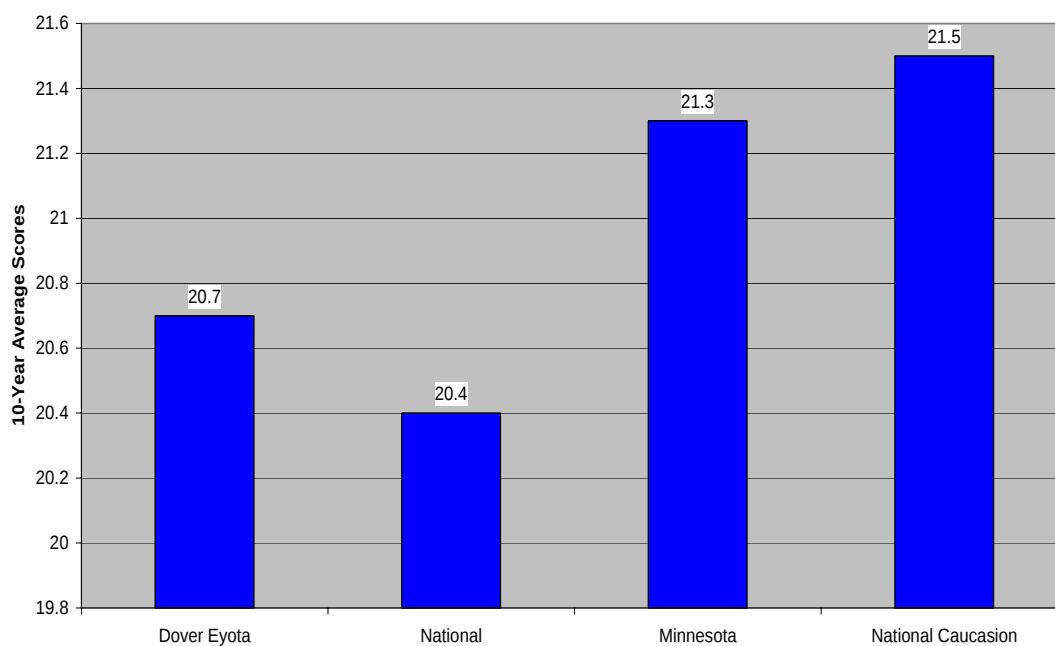
I see social studies as a field that draws a large number of quality individuals to teach in it. In the area where I teach it is typical for hundreds of applicants to compete for a given job. Because of this I find that teachers who do get hired tend to be some of the most capable individuals in a school building. The focus of my teaching has now grown to learn in what

ways I can help students beyond that which is in my curriculum. I feel that it is my responsibility and it has become the focus of all of my Masters Degree work.

Need for the Study

At the high school involved in this research (Dover-Eyota on the graph) the students historically perform well above Minnesota averages for math and science portions of the American College Testing exam. The exception on the ACT is the English portion of the exam. The numbers provided by ACT.org and Dover-Eyota school counselors demonstrate that the 98% white, students of this Minnesota High School under-perform when compared with their peers. The graph on the next page will illustrate that discrepancies, it should be noted as well that the researched students are 100% English speaking as their first language which is not necessarily defined on the graph,

Comparison of English ACT scores from 1996-2005



Deficiency in such a broad test of English ability as the ACT must be seen as the responsibility of more than English curriculum teachers. In the eyes of the researcher Social Studies was one area which could focus on improving student English skills, the research tool studied was one way in which gains could be sought.

Purpose of the Study

Students in American high schools are given a variety of classes and experiences to draw from that are designed to educate them. If these classes can build off of each other the entire experience will be more beneficial. This study sought to create a tool which would enhance students' ability in English language usage by utilizing what they learned in social studies.

Students encounter significant new vocabulary in social studies for which this study sought to improve their retention. The journal of words that students were required to maintain sought to decrease the chances that the new vocabulary would be lost. The journal mandated that students acknowledge which words they did not know, keep track of those words, and clearly define them. The study has as its' goal that those words would then become part of the students' casual speech.

Statement of the Hypothesis

If high school students maintain a list of vocabulary words they encounter in Social Studies which are new to them, the grade level at which they write will subsequently increase.

Definition of Terms

ACT – American College Testing, a commonly used placement exam by potential college students.

AMERICAN STUDIES: A course offered at the school in which the research took place, a senior course combining American history with principles of economics

BLOCK: An 88-minute class period. See FOUR-PERIOD-DAY.

CAUCASIAN: In the United States, it is currently used primarily as a distinction loosely based on skin color alone for a group commonly referred to as *Whites*.

FLESCH-KINCAID: Readability tests designed to indicate how difficult a reading passage is to understand.

FOUR-PERIOD-DAY-The students attend four 88-minute classes each day. A course using a traditional seven or eight period schedule would meet 45 minutes each day for a year. That same course on a block schedule would meet for one semester.

MICROSOFT WORD: A word processing application from Microsoft corporation which contains the Flesch-Kincaid (see above) measurement within it.

RETENTION-The transfer of knowledge into long-term memory.

TRADITIONAL DELIVERY OF CURRICULUM: A primarily executive style of instruction utilizing a variety of media and sources.

Variables

Independent Variable

The number at which Flesch-Kincaid establishes the students' grade level of writing after the control period and the number taken after the experimental period are the independent variables in this research.

Dependent Variable

The dependent variable will be the positive or negative change exhibited by the control and experimental groups.

Control Variables

- All students took the course as a pre-requisite for graduation.
- The Flesch-Kincaid measurement was a constant, used for all evaluations of student work.
- The same teacher taught all classes involved.
- All students were in the same (12th) grade level.
- The primary reading material (American History Text) was the same throughout the study.

Moderator Variables

- o Students were divided (randomly) in to two separate classes with different personalities in each. Time of class differed as well.
- o Subject matter was different during the control and experimental periods. Different time periods in history were studied.
- o Students' schedules outside of American Studies differed significantly. Some students taking more advanced/demanding courses than others.

Limitations of the Study

In evaluating the research the most prominent limitation relates to the short-term observation of improvement or decline. The researcher took measurements of grade-level writing immediately after the vocabulary lists had been utilized. No follow up measurements were taken to demonstrate that lasting effect/benefit had occurred. It is entirely possible that what improvement the test appeared to have garnered may or may not have long term significance.

A further limitation of the study lies in the correlation of increased vocabulary to that of increased writing level. The literature review done as part of this research demonstrates that retained vocabulary will appear in casual writing, however the tool measuring grade level (Flesch-Kincaid) takes in to account more than one factor in its' assessment.

Flesch-Kincaid itself is a limitation of the study as researchers differ over its' validity. Opinions vary on its' authenticity from being 95% accurate to off by as many as three grade levels (Little, 2006). The Flesch-Kincaid does provide a constant but a limitation lies in its' potential lack of credibility in American academia.

CHAPTER II: LITERATURE REVIEW

In reviewing the literature that pertained to this study there were several directions in which relevant research was available. The relationship between vocabulary development and success in school was the first angle looked at. The material led as well to an examination of a variety of costs and benefits connected with taking time to focus on vocabulary in a non-English curriculum classroom. The literature review eventually found numerous reasons for such a study as this; those reasons are outlined in this section.

Why Utilize the Vocabulary Lists?

In *Current Research and Practice in Teaching Vocabulary*, Davig Beglar and Alan Hunt used seven principles to provide a framework for vocabulary development. Three of the seven principles relate directly to the practices of this study. Principle three, “Provide opportunities for the intentional learning of vocabulary” notes that vocabulary must come from sources beyond simply reading and participating in course material. One common myth is that by engaging in coursework that incidental learning provides for advancing vocabulary. Beglar and Hunt included however the quote “intentional learning through instruction also significantly contributes to vocabulary development” (Beglar & Hunt, 1998). The use of vocabulary lists and their definitions in this study provides the direct instruction of which they wrote.

A second principle in the Beglar and Hunt study was that of “Experiment with guessing from context.” (Beglar and Hunt, 19982004). This principle seeks to help the teacher understand that students who can find word meanings on their own are more likely to retain that meaning. (As students were forced to maintain lists one tendency that grew was that of guessing at definitions using context before looking them up) When guesses proved true, the meaning was significantly more beneficial. The study further suggested that

curricular material will also be enhanced by the use of context. A word of caution was included with this principle that “given the continuing debate about the effectiveness of guessing from context, teachers and learners should experiment with this strategy and compare it to dictionary training” (Beglar & Hunt, 98).

Correlation Between Vocabulary and School Success

“If we are serious about ‘increasing standards’ and bringing a greater proportion of school children to high levels of academic accomplishment, we cannot continue to leave vocabulary development to parents, chance, and highly motivated reading” (Stahl, 1999). The words of Steven Stahl note the importance of vocabulary development and school success. The research noting the correlation between the size of one’s vocabulary and their performance in school is extensive.

One example of research which studied the link between vocabulary and school performance was that of Cynthia and Drew Johnson of Anaxos, Inc., a education research company. They noted that especially for poor readers their struggles with reading early in school can stunt their vocabulary growth. As years pass this lessened vocabulary prevents comprehension of more complex concepts and classes. “This perpetuating cycle can mean that as students continue through middle school and high school, the gap between good and poor readers grows wider. Direct instruction can help arrest this cycle” (Johnson & Johnson, 2005).

The Value of Teaching Vocabulary in Social Studies

Some research has been done in the area of using Social Studies to enhance vocabulary development. The research largely credited each academic discipline with having

its' own distinct vocabulary. One statement which encapsulates this idea well is, "because vocabulary development does facilitate learning and because each subject area has unique terms, we believe social studies teachers, as well as other subject matter teachers, can facilitate learning by assuming responsibility for vocabulary development." (Milligan & Ruff, 2004)

A requirement for teachers with limited class time is that an instructional tool take up as little time as possible. This element was also addressed by Milligan and Ruff, a notable quote from their work states their point, "...it is our view that vocabulary instruction need not take an inordinate amount of time nor should it be tedious for students or teachers" (Milligan & Ruff, 2004). Their study went on to extensively document that time dedicated to vocabulary development actually increased subject matter retention and thus free up time that would otherwise be required for review.

Although not specific to social studies, significant research was found on the value of content area vocabulary development. Edyth Young's, *The Language of Science, The Language of Students*, emphasizes that often gaps of achievement between students can be bridged by ensuring that all students understand the words being used during instruction. This study focused on science but could be easily transferred to any subject, as both subjects are loaded with concepts and terminology that is unfamiliar to many students. Whether science or social studies, the literature suggests that teachers must:

1. Contextualize word meanings
2. Establish relationships between new vocabulary and those students already know
3. Provide multiple exposures and usages of words

All three of these actions are best done within a content area, by instructors trained in that content. (Gunning, 1998)

Improving Writing Skills In Relation to Vocabulary Development

The need for an extensive vocabulary for proficient writing is prominently noted in the study by the American College Testing exam. The ACT now has not only an English portion on its' exam, but has recently added a writing portion as well.

The literature available on writing notes that social studies classes play an important role. Frederick Risinger noted the importance of using social studies to improve writing skills. His contention was that particularly in persuasive writing, the social studies can help with students difficulty organizing their thoughts coherently in writing (Risinger, 1987). The particular application of Risinger's research to this study was that enhanced vocabulary could lead to enhance persuasive abilities of writers. As persuasive writing is a significant element of social studies classes, the research demonstrates particular application to those classes.

CHAPTER III: METHODS AND PROCEDURES

Overview

At the beginning of the Fall semester of 2005, students were asked to provide a sample of casual writing. Given a choice of several prompts, they were asked to write a minimum 300 word response which was then evaluated for grade level at which they wrote (according to the Flesch-Kincaid grade level readability formula). For the first seven weeks of class students were taught in traditional manner and not required to note new vocabulary. After the initial seven weeks students provided a second writing sample, again evaluated for grade level. The final seven weeks of the experiment students were required to maintain a list of words they encountered in class which were new to them. After those seven weeks a final writing sample was taken and evaluated.

Design

The study was designed so that students would provide uncompromised data in a manner that did not detract from the coursework. Writing grade level scores were compared before and after the control period, as well as before and after the test period. Comparing the growth in each period provided the data used in evaluating success of the research tool.

Selection of Test Subjects

The test participants were all high school seniors enrolled in one of two American Studies courses. The course is a graduation requirement for all of the students and thus enrolls the entire range of abilities. The seniors were chosen due to the researcher's familiarity with the subject matter and thus ability to keep the control and test periods as similar as possible.

Measuring Devices

The measuring device used to judge at what grade level students wrote was the Flesch-Kincaid grade level measurement. Utilizing the Microsoft Word software, the researcher input students' writing samples in to the test device and recorded the number at which Flesch-Kincaid evaluated their writing. The Flesch-Kincaid measurement comes from the following equation:

$$(.39 \times \text{ASL}) + (11.8 \times \text{ASW}) - 15.59 = \text{Grade Level}$$

where:

ASL = average sentence length (the number of words divided by the number of sentences)

ASW = average number of syllables per word (the number of syllables divided by the number of words)

*It is important to note that numbers used as constants in the above equation are little more than that, constants. When Flesch and Kincaid created the formula they found the above numbers worked to achieve the results they desired. The numbers and equation have been used effectively for over 40 years.

Validity Measures

The prompts themselves were similar each time given, Flesch-Kincaid not requiring exactly similar prompts. Students were not made aware that they were being evaluated by grade level of writing, only that their responses would be kept for my records. The course work was similar during the test and control periods of the research but not identical. The curriculum used was part of a recent American History class which covered different time periods during the control and test periods. The difficulty and amount of reading and curricular material was kept as similar as possible for the two periods studied.

Validity

A study is valid if it measures what it is supposed to measure. In this study, the researcher was measuring the effectiveness of maintaining a vocabulary list in a social studies class. A t-test was done to establish the significance of the data gathered. The one-tailed probability was tabulated as 0.01, which shows a confidence interval of 95% or higher. In scientific research, a study is significant if the probabilities are less than or equal to 0.01, therefore the hypothesis for this study can be considered to have statistical significance. A summary of the t-test data from VassarStats.com is provided on the following page.

Values	X_A (control period)	X_B (experimental period)
N	58	58
Sum	9.1	21.7
Mean	0.16	0.37
Sum squared	13.57	26.97
SS	12.14	18.85
Variance	0.21	0.33
Standard Deviance	0.46	0.58
Mean_A - Mean_B	T	Degrees of Freedom
-0.22	-2.24	114

Probability	One-tailed	0.01
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With validity, there are two types of threats that can occur in a study- internal and external threats. This study proved to have few external threats, yet certainly the teaching techniques employed by the researcher could have varied based on the different student dynamics within the two classes studied. However, there were several threats to internal validity. During the course of this study, there were three students who were exempted from the study due to their special education accommodations. Experimenter bias could have been a threat as the researcher may have inadvertently altered curriculum to favor the experimental period. A final threat to validity may have shown with the maturation of the students. The first measure of grade-level writing may have been low, due to students coming off of a long summer break. This could have increased the growth numbers during the control period, and as such, causing the benefit of the research to seem less significant than it actually was.

Reliability Measures

The exact same prompts were offered each time students were required to provide writing samples. Flesch-Kincaid was the measurement for grade level at which students wrote; this was the case for all three writings. Flesch-Kincaid requires a minimum of 300 words to record an accurate result, because of this student writings were required to be no less than that 300 words. The final measure of reliability sought in this research was that of using multiple subjects. Sixty-two students in all were used for the study, this was the largest number of students available (taking the same course at the same time) to be studied.

Field Procedures

The independent variable was whether or not students were required to maintain a vocabulary list. For the first seven weeks students did not maintain lists nor pay any special attention to vocabulary development. The following seven weeks, the students were required to maintain the list. The dependent variable was the amount of change in student writing levels. Amount of change after the control period was compared with change after the experimental period.

. Students were required to write in longhand word they encountered while working with class material, in the back of the class notebooks. The requirement was 20 words per week, which they then must define. The instructor was available to help with some words, however the majority were to be looked up in a dictionary by the students. Words could come from in class activities, homework, or learning experiences which had to do with course work currently underway. One such learning experience might be watching the History Channel's program about Sputnik while the class is studying the Space Race.

Students were required to maintain the lists throughout the remainder of the semester. By connecting part of their participation grade to the maintaining the lists, all students eventually complied with the directive to maintain and interact with the lists.

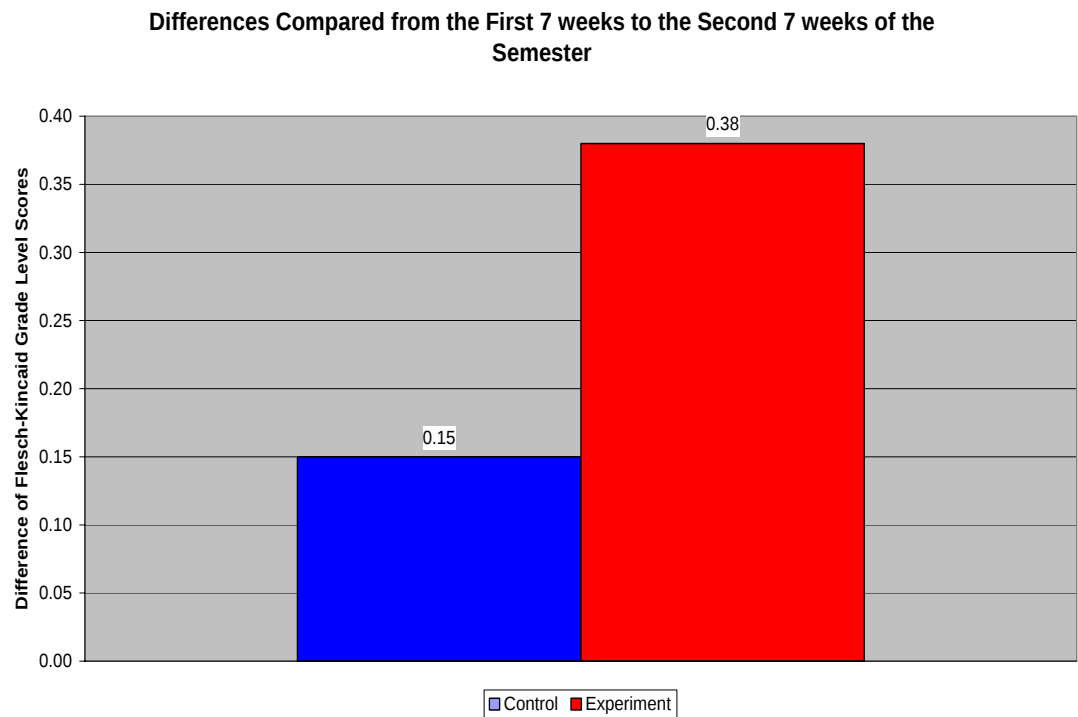
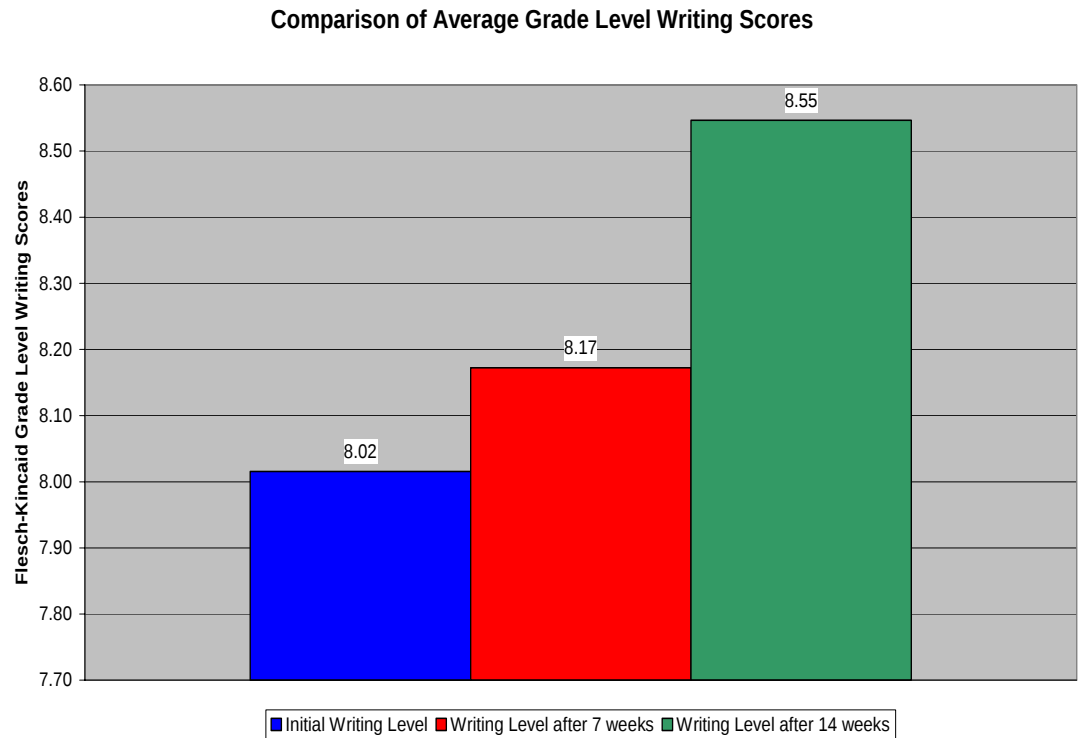
Conclusion

By focusing on new vocabulary encountered during social studies class, the results indicated students were more likely to retain that vocabulary and use it in casual writing. The Flesch-Kincaid scale showed that students' writing level increased in both the control and experimental periods. The experimental period did show a larger increase in writing level

than the control, almost twice as much.

CHAPTER IV: RESULTS AND DISCUSSION

Results



Discussion

Data was gathered from 58 students in total. Sixty-one students began the study, three were pulled from the study by their Special Education instructors due to conflicts with their IEP's. Those students' data was not considered in the previous charts.

The research demonstrated that maintaining vocabulary lists in social studies class had a positive impact on writing levels of students. Statistical analysis of the data gathered showed that although students did increase writing level without the lists being used, the increase was significantly greater with the lists.

At the beginning of the semester, writing prompts scored by the Flesch-Kincaid method found the average test subject wrote at an 8.02 grade level. After the seven week control period in which the research tool was not used, the average change in writing level was measured at a positive .15, bringing the average for the 58 students to 8.17. At the conclusion of the seven week test period, the average change was a positive .38, resulting in a final writing level of 8.55 on the Flesch-Kincaid scale.

CHAPTER V: SUMMARY AND CONCLUSIONS

Summary

This research was begun with the intention of making a social studies class benefit students beyond improving their knowledge of historical events. The aim was to make them stronger by helping them retain much of what was otherwise lost. The tool used was simple, a mere list of unfamiliar words to define and hopefully incorporate in to casual speech. I intended it to be simple to provide distinct and substantial data, this objective material was gathered and productively used.

The students took a traditional course in American history for seven weeks taught the way I have taught it for six years. In the following seven weeks I taught as much as possible in the same fashion as before, but while requiring students maintain the vocabulary lists. Some difference did arise between the two periods in that often during the experimental period lectures were interrupted by requests to repeat and even spell unfamiliar words.

Quantitative results were significant and positive. Although student grade-levels of writing increased in both the control and test periods, the test period measured an increase nearly twice that of the control period. The measures of validity including T-tests noted that results were valid to a degree of 95%. Several of the students did not improve more during the test period accounting for the 5% discrepancy but the numbers remained in an acceptable range for most statisticians.

Subjective results were mixed, as the day to day implementation of the vocabulary lists was at times tedious and time consuming. Having started the semester not using the lists students often resented what they perceived as an extra burden in their daily work. The number of required words seemed intimidating to many students which, in two cases, led to outright refusal to continue with the experiment (Special Education teachers threatened to

write exemptions from vocabulary lists in to individual education plans due to one student's reaction). A separate notable negative effect was that the lists seemed to detract from students' enthusiasm for the subject matter. The reduced enthusiasm I found particularly troubling.

Positive subjective observations were made as well. Students were noticeably impressed by the size (or lack there of) of their vocabularies. It became a source of pride for some to help others with definitions, cooperative learning which resulted was quite positive. Students seemed to ask more questions not only of each other but of their instructor, providing for many positive learning interactions.

Through both quantitative and qualitative measures the experiments was generally a success. My initial goal for this research was to make my class more meaningful and farther reaching for students, I believe this was to a certain degree attained. The process was certainly not without drawbacks but end results outweighed the costs and pitfalls during the process.

Conclusions

Although this research technique was chosen initially for its simplicity significant drawbacks were evident throughout. The principle concern was how to measure the positive impact on language skills provided by the vocabulary lists. Improvement on the American College Test was inspiration for the study but whether the lists could help students on those tests was not addressed by the research. Reasons this was not possible include the short time frame used in the experiment (only fourteen weeks) as well as the age level of the students in the study (high school seniors). In retrospect, the study would have had more applicability if used with sophomores or first semester juniors who have yet to take the ACT. The measure

used to prove or disprove the worth of the lists was instead of the ACT, the grade-level at which students wrote.

The Flesch-Kincaid score as a measurement to determine the research's success or failure was flawed. The research tool (vocabulary lists) focused on increasing vocabulary, not necessarily words of great complexity and size. Although a fair assumption can be made that complex words are more likely to be unfamiliar to students, the Flesch-Kincaid scale only uses size of words as one of two barometers. Half of the scale comes from the complexity of sentences written by students which was not the focus of the research, yet is reflected in the data.

The researcher found potential flaws in the technique as students' negative energy surrounding the subject matter was subjectively observed to increase substantially. Students who previously were enamored with the course and curriculum often resented what they perceived as "busy work" not relating to learning history. This did not necessarily reflect in the quantitative results of the study, however may have had a negative long-term impact on the students' desire to continue learning about history.

A positive conclusion I drew from the study was that in conducting this research I found overwhelmingly that my students felt a "permission to forget" new words, and for that matter, any knowledge that may not appear on an exam. The vocabulary lists seemed to be a good idea to limit the new words from escaping their minds, but came to remind them of the information the vocabulary came from. The curriculum benefited by students repeatedly experiencing many words and phrases (such as Sputnik or Microprocessor) helped them retain curricular knowledge.

Recommendations

In presenting findings to colleagues, peers, and advisors several suggestions arose which would be beneficial to further study in this regard. Suggestions included using a readability scale other than Flesch-Kincaid, or using multiple scales. Other suggestions were to keep writing prompts constant throughout the study to achieve more accurate numbers. A final suggestion was to allow students to be aware that the study was taking place; this suggestion I disagreed with as I feel it would have been a significant risk to validity.

In completion of this work, I noted a number of changes that I will make in the future. First and foremost I plan to analyze the positive effect the lists may have on retention of curricular material. Currently, I am using the lists with tenth grade students to analyze whether it will increase average scores on final exams. Because much of the “new” vocabulary students found was social studies specific, potential in this area is significant.

Future researchers considering this technique would do well to take in to account the potential negativity generated forced maintenance of the lists. This is dangerous as it can impact internal motivation to learn the subject matter. A recommendation I have is to present data to students on the positive impacts the lists carry with them, at the beginning of the semester. I believe if students understand and agree with the purpose of the lists they are more likely to “buy in.”

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APPENDICES

Appendix A

First sample of student writing, taken at the beginning of the American Studies course.

Prompt Used: What makes a good social studies class?

What makes a good social studies class? A good teacher helps to make a good class. If you enjoy the teacher then you should also enjoy the class. The better teachers use more than one teaching stile, because it is easer for more people to learn. A good teacher answers questions and is well informed in there topic that they are teaching. The teachers should not be such a doorknob, which means jerk but that doesn't mean you. These teachers should not be afraid to have some fun and lighten up because this in not collage. There grading scale should be 90 80 70 60, because that's the easiest. Tests should not be 50 percent of the total grade, because there are people that will study hard and they are just really bad test takers, so they do horrible, and horrible in the class. They should also do lots of projects in groups or by themselves and for groups the teacher should pick them so that it forces people who normally don't talk to each other to work together.

When teaching, teachers should show movies that correlate with the topic that they are talking about. And if tree are no movies on the topic or they should come up with a song or a story that will help the kids remember what they are currently talking about. I find it easer to learn about certain topics that way.

The students that are in class now will be the leaders of the countries tomorrow, so teachers should be given a higher salary, the same amount as a doctor. All teachers have their favorites and I think they should because it's the nerdy people who have a tendency to be the teacher's pets. Good teachers are not only involved in teaching they should also be involved in extracurricular activities like drama or sports.

Flesch-Kincaid Grade Level = 8.5

Appendix B

Second sample of student writing, taken after the control period (first 7 weeks) -

Evaluated for Grade-Level

Where will America be in twenty years? I think that America will fall like Rome. America is getting lazier and lazier so pretty soon we will all be extremely fat, with adult onset diabetes, we are becoming this because technology is getting so great that it will be are downfall. We are also letting illegal immigrants come and do the little things and getting paid. We are also getting so big that we will be spread out so thin we will easily be slaughtered. I think to stop that from happening everyone who is 18 to 22 should be required to join the military.

They say that Rome wasn't built in a day but it pretty much fell in one, and I think that that will happen to us. But before we fall the entire west coast will be under water. I think that we need a woman as president I would vote for Candelisa Rice, I like her but I don't think that much will be done in her first term. I think that in 50 years there will be another world war and in that war nuclear bombs will be used and will slaughter almost everyone. The people that do survive will have a higher chance of getting cancer then they will die. That will be the end of mankind.

We will have to switch for using foreign oils to domestic products like ethanol, or water. We should push congress to have a completion to get the first mass produced and affordable car that runs on water on the market, the winner should get a prize like one billion dollars. But all is not lost for if we change now we will have a better chance of getting generations after us to continue living. America will probably take over most of the free world except for our friends.

Flesch-Kincaid Grade Level = 8.8

Appendix C

Third example of student writing, taken after the experimental period (taken after weeks 8-14). Evaluated for Grade-Level

Prompt chosen: What about a President could inspire you?

What about a president could inspire? Well I'm not too big into politics so I would say that the president would have to be a lot like JFK, young and someone who was very likeable. He should also motivate people, especially the younger generations.

Why I think that a president should be like JFK is that he motivated people to join the Peace Corps, and had them think that they could make a difference in the world, because that is what most people wanted to do, was to make a difference. So through the Peace Corps, young people thought that it was their ticket to do that. If we have a younger president he or she has a higher probability of getting the younger generations more involved in politics. So it makes them feel like they are influencing the government. I think why JFK was so likeable is that he was good with people and he didn't have enough time to screw up so in the hearts on the generations before us he was the best president ever.

I think that if there is a crisis of some kind no matter if it is the Cuban missile, or 9 11 when things like that happen the country looks to the leader at the time waiting for him to react and through that more people are inspired to go out there and do something. The same thing happened at Pearl Harbor and that put us in to world war two.

Something that also helps the president is the first lady because like chess she pretty much has the real power. The Roosevelt's are an example of this because Eleanor was loved by all the country. When Reagan was president he sometimes could not sign and papers because of his degenerating disease so his wife signed it for him, and when the whole Monica L. scandal was going on Hillary was pretty much in charge.

Flesch-Kincaid Grade level 10.5

WILL A SUPPORT MATH CLASS FOR A SEMESTER HELP LOW-ABILITY
EIGHTH GRADE STUDENTS RAISE THEIR SCORES ON THE MINNESOTA
BASIC SKILLS TEST?

By

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B.S., Winona State University, 2000

An action research project submitted to the
Graduate School of Winona State University
in partial fulfillment of the requirements for the degree of

Master of Science

Department of Education

April 2006

This action research project entitled:

WILL A SUPPORT MATH CLASS FOR A SEMESTER HELP LOW-ABILITY
EIGHTH GRADE STUDENTS RAISE THEIR SCORES ON THE MINNESOTA
BASIC SKILLS TEST?

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The signatories have examined this project, and we find that both the content and the
form meet acceptable presentation standards of scholarly work in the above-
mentioned discipline.

Pittenger, Nicole (BS, Education)

WILL A SUPPORT MATH CLASS FOR A SEMESTER HELP LOW-ABILITY
EIGHTH GRADE STUDENTS RAISE THEIR SCORES ON THE MINNESOTA
BASIC SKILLS TEST?

Research project under the direction of Dr. Thomas Sherman, Heather Klees and
Cheryl Moertel.

Abstract

Mathematics requires students to retain many new skills each year because it is mainly cumulative. Students in the Rochester School District and around the state have difficulties passing the Minnesota Basic Skills Test (MBST) they take in eighth grade because they may not be retaining the basic math concepts. A support math class is one way to help students retain these skills as well as reinforce the new skills being taught at the students' grade level. Students are given practice tests, as well as strand-based worksheets to allow them the extra practice needed to pass the MBST by the end of their eighth grade year. If these low-ability students can understand the concepts that are being presented to them daily, as well as previous concepts, then they may be more successful in their continued schooling and life in general. The effectiveness of this approach was measured by comparing a pre-test given during the first week of September and the actual scores from the Minnesota Basic Standards Test taken by the students in February of 2005. The pre-test was a sample test from the previous year's Minnesota Basic Standards Test, taken from the Minnesota Department of Education's website. Since the MBST's occurred at the end of the student's time in the support math class, the dependent variable was the students'

success over the first semester of their eighth grade year. Students whose scores were used in this study were placed in a Target Math class, and were pre-selected to take Target Math as an extra math support class based on their previous standardized test scores. The comparison students were randomly chosen from the remaining eighth grade math teachers' class lists. Literature supports that the teaching of mathematics basic skills through a small class setting will increase the amount of information retained by the low-ability students, as well as increase their test scores. Students will overall be more successful and less frustrated than in their previous years of math. It should also be noted that the lower student to teacher ratio increased the one-on-one time these student received. The benefits to a smaller class for low-ability students clearly boosted their self-confidence in mathematics, thus decreasing their frustration and failure rate both in their classroom and on the test scores.

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CHAPTER I: INTRODUCTION

For the past four years I have taught Target Math students at F.B.K. Middle School in southeastern Minnesota. Target Math is a supplementary math class for students who are two to three years below grade level, as determined by test scores. All of the students enrolled in this class have low test scores, as well as strong teacher recommendations. The students take this class as a second math class during their target time (study hall) so they can gain the math skills that they are missing. There is a maximum of 15 students enrolled in each Target Math class so that the students have a 1 teacher to 15 student ratio instead of the typical 1 to 30 ratio found in other classes. The Rochester School District began the Target Math program as a way to help close the gap. Last year was the first year I taught the Target Math students exclusively, while the other years I have taught a combination of regular and Target Math classes. This study focused on the eighth grade Target Math students, and their growth from the pretest to their actual score on the Minnesota Basic Skills Test (MBST).

Teaching Target Math students exclusively was quite a challenge, yet rewarding to watch the growth in the students. One of the biggest challenges that came with teaching Target Math was the communication between the Target Math teacher and the regular math teacher. In order to make sure these students succeeded, there needed to be a connection between their everyday math class and their every other day Target Math class. Monitoring the weekly assignments, weekly updated progress reports, and any test scores that were done in their math class helped the Target Math teacher understand where the students were missing information in their

math knowledge. That information assisted the researcher in adjusting the lesson plan to meet the needs of the students. The challenge rose in gathering and critiquing all the information in order to make the adjustments needed and the time constraints associated with that.

Another challenge with the Target Math class was the combination of special education students, students with Attention Deficit Hyperactivity Disorder (ADHD), and other low ability students. The mixture of learning abilities demanded flexible lesson plans as well as an increase in time spent with each student. These students already had challenges to the learning process, and the Target Math teacher had the job of closing the gaps in math. The most effective way to get the students to be more willing and excited to learn was to develop a relationship with them. Most of the first six weeks of school was spent on getting to know the different learning styles and personalities of the students, as well as their family backgrounds and hobbies. Once a trust relationship was developed, the students were willing to try the math and were receptive to words of encouragement.

Need for the Study

The state of Minnesota requires students in eighth grade to pass a Basic Skills Test in mathematics before they can graduate high school. According to Davison, Peterson, and Schleisman, “there are very few studies and reports about remediation efforts, and most describe remediation efforts associated with assessment programs from the 1970s and 1980s. Therefore, it is important to document what schools are doing to improve results and help students (2001).” At F.B.K. Middle School, one of the goals for the 2004-2005 school year was to have ninety percent of the students

pass the MBST during their eighth grade year. One of the resources used to help the lower ability students raise their knowledge so that they could raise their scores was a Target Math class with approximately 12-15 students. In the Target Math classes, the students practiced the different strands that are covered on the test in a setting of lower student to teacher ratio.

Statement of the Problem

The low-ability students have difficulty passing the MBST because they are not retaining the information they were taught in elementary school. For some students this is because of learning disabilities, emotional, behavioral disabilities, or other behavioral issues. These students needed a more focused, intentional study of basic math skills in order to progress into more complex math concepts. If these gaps are not addressed, then these students have a difficult time with future math classes, and the possibility of graduating high school declines. Will the incorporation of a support math class for a semester help these low ability students raise their test scores on the MBST?

Purpose of the Study

At F.B.K. Middle School, one of the goals for the 2004-2005 school year was to have 90% of the students pass the MBST during their 8th grade year. One of the resources they used to help the lower ability students raise their math knowledge so that they can increase their test scores was a Target Math class. The goal of Target Math is to help more students increase their chances of passing the MBST through practice of the different strands covered by the test. This study was done so that my

colleagues could see how successful Target Math is and its importance to raising the test scores at F.B.K.

Statement of the Hypothesis

A support math class for a semester will raise the test scores of low ability students on the Minnesota Basic Skills Test more than the students who don't get support.

Definition of Terms

STANDARD: A degree or level of requirement, excellence, or attainment.

STANDARDIZED TESTS: a written test whose scores are interpreted by reference to the scores of a norm group which has taken the test and which is usually considered to be representative of the population which takes the test

MINNESOTA BASIC STANDARDS TEST (MBST): Designed as a test of the basic skills that all students should have. All eighth grade students are required to take the Minnesota Basic Skills Test (MBST) in reading and math. Minnesota State Law requires students to pass the test in order to graduate from High School.

STRAND: There are 8 strands on the MBST that encompass the standards that the students need to complete before they graduate High School.

NO CHILD LEFT BEHIND (NCLB) ACT: A significant accountability measure for all public schools that states that *ALL* children will be proficient in reading and math by 2014.

ADEQUATE YEARLY PROGRESS (AYP): One of the essential elements of NCLB and probably the most complicated. To achieve the goal of all children being

“proficient” (as defined by each state) by 2014, all public schools and districts must make satisfactory improvement each year toward that goal. Based on criteria included in NCLB, the Department of Elementary and Secondary Education has established specific annual targets for AYP in communication arts and math.

REMEDIATION: A reiteration, or re-teaching, of basic skills already presented to, but not learned by students.

Variables

Independent Variable

The scores of the students will be taken from students who are in a support math class and students who are not in a support math class.

Dependent Variable

The growth that each group has made from the pre-test to the MBST depends on the support each was given.

Control Variables

All students are 8th graders. The students in each situation were pre-determined before the school year started. They all will be taking the same tests. All of the support math class students will be doing the same practice work. All support math class students will have the same teacher.

Moderator Variables

The support math students are only seen every other day, which means that some weeks the teacher will see the students three times and other weeks the teacher will only see the students two times. Each of the support math classes have a pre-determined set of strands that they need more work in, which

means that not all of the support math classes had the same emphasis on the same strands. At least half of the students in the support math class were part of some level of Special Education. The pre-test and the MBST were taken at different times of the day with different teachers. The pre-test was taken during the students' math class throughout the eight hour day with their math teacher, while the MBST was taken during the morning hours with the advisory/homeroom teacher.

Limitations of the Study

One of the support classes was cut short because of the way the schedule was set up. Another support class was mixed in with 7th grade students learning different material. Not all of the support class sizes were equal- they range from 7 students to 15 students. There were students who had attendance issues, as well as tardiness issues that affected their potential to receive support. Bad behavior was not tolerated in the support class, which means that some students might be sent to the office, which in turn affects their potential to receive support.

CHAPTER II: LITERATURE REVIEW

There have been many different ideas on how to raise student test scores. Before a teacher can even begin to look at those different ideas, they need to have a basic understanding of where standardized testing came from and how it affects students' abilities to learn in the classroom. The following gives background information on why standardized testing began which lead to the Rochester Public School District results and how they have used the idea of a support math class to help raise their test scores.

Standardized Testing

The importance of Standardized tests has increased notably over the past 20 years. In 1983 the report *A Nation at Risk* emphasized accountability within American schools (Gardner, 1983). The passing of *Goals 2000: Educate America Act* followed in 1994 and led to the development and publication of national standards in specific subject areas (Congress, 1994). The reaching of these standards has since been evaluated through the use of standardized testing. These tests are administered and scored in a uniform, predetermined manner (Popham, 2001).

Minnesota State Testing

In 1993, The Minnesota State Legislature passed into law a results-oriented Graduation Rule. One component of the Graduation Rule focuses on basic standards, which define the proficiencies in reading, mathematics, and writing that a student must possess before graduating from a Minnesota public high school (Schleisman, Peterson, & Davison, 2000). The basic standards are measured by the Minnesota Basic Standards Tests (MBSTs) beginning in eighth grade. In Minnesota, the

accountability component falls not only on students, but also on schools and districts because the results of the MBSTs are published in local newspapers. Because Minnesota schools are now more accountable to the public, educators face an increasing need to find ways for students to succeed. For students who have trouble passing the MBSTs, policymakers state that “local districts offer a variety of services to students who do not pass the tests” (*Policy and Guidelines*, 2001), which means that each district is responsible for coming up with their own way to help the low-ability students in their schools.

Schleisman, Peterson, & Davison researched the many different ways that districts offer services to students who do not pass the MBST in eighth grade. They found that districts were placing extra focus on teaching the basic skills within the curriculum, as well as offering several categories of additional instruction to students. Some of the options that were offered included: basic skills classes offered during the regular school day, a focus on reading and math across the curriculum, summer school programs, and study packets. They discovered that schools and districts were also experiencing several non-curricular implications related to the MBSTs, which included: student motivation, participation, and attendance in remedial programs; students who transfer into districts in their later school years; how to address both the high standards and the basic standards; administrative and organizational issues, such as hiring, scheduling, and transportation; and evaluating the effectiveness of these additional instructional opportunities (Schleisman, Peterson, & Davison, 2000).

The study done by Schleisman, Peterson, & Davison also found the North Carolina Instructional Services Division gave the suggestion to their schools and

districts that a possible way to offer remedial programs “might be through smaller classes” (Gallagher & Ramsbotham, 1978, as cited in Archambault, 1979). Davison, Peterson, and Schleisman found that different schools and districts in other states also found the idea of remediation to be effective. Some schools developed basic skills courses, where the curriculum is designed specifically for helping the student master the basic skills tested in that subject area. In a study done by the Ohio Legislative Office of Education Oversight (1993), the researchers found that some of the most frequently reported types of remediation included study hall subject remediation and required courses scheduled during regular school days. *The Indiana Basic Competency Skills Testing and Remediation Program Manual* (Indiana State Department of Education, 1985) defines a remedial program as “...one which determines each student’s knowledge deficiencies and provides instruction designed to assist students in overcoming the identified deficiencies.” It is such a program that is the new focus of education in a world of standardized testing.

No Child Left Behind Act

President George W. Bush’s *No Child Left Behind* initiative (Bush, 2001) was signed into law on January 8, 2002. The federal government implementation of *No Child Left Behind* placed pressure on Minnesota and all states to close achievement gaps between the various demographics. The program emphasized an "accept-no-excuses" environment of school accountability which lends itself well to standardized testing. The tests neither focus on, nor allow for explanations for failure. At its basic intentions all students must either succeed or they and their schools will be exposed as failing through objective standardized tests.

Testing Effects on Students and Schools

W. James Popham, in his book *The Truth About Testing*, stated “Because of the unsound high-stakes testing programs, many students are receiving educational experiences that are far less effective than they would have been if such programs had never been born.” He went on to talk about how the less effective curriculums increase the need for extra programs to supplement and to help increase students test scores. Popham further noted “The quality of schooling was being linked to the quality of students’ test scores” (Popham, 2001). Standardized testing created a complex duality between the actual performance of an educational institution and its perceived performance.

The conditions facing modern U.S. educators was further addressed by Popham, “These rankings invariably lead to judgments about which educators are doing good jobs and which are doing bad jobs. And because citizens believe that high scores signify successful instruction, the annual rankings place enormous pressure on teachers to improve their students’ scores on statewide tests” (2001). The pressure of which Popham speaks may be linked to the decline of schools peripheral programs and thus overall educational experience as resources in modern schools are potentially being diverted to only the subjects tested. W. James Popham eloquently said, “Because U.S. society currently accepts the idea that good test scores equal good education, everybody wants students to score well on high-stakes tests” (2001).

Rochester Results

The literature and statistics regarding Rochester, Minnesota, and standardized testing are notable. In February 2004, the MBST results in math were equal with the

state of Minnesota with 71% of the students passing (Minnesota Department of Education, 2004). Previously, Rochester had been ahead of or on top of the state scores. In the spring of 2004, Rochester School District recognized a need to give low-ability students extra help. The school district decided to implement a support math class (Target Math) during the low-ability students' study hall across the district, and made sure it was being taught in a unified form.

Most recently, in fall of 2004 all Target Math classes were taught by one teacher with an 84% passing rate in February 2005; the 84% was once again above the state of MN average. The district had previously tried to implement a similar program in the Fall of 2003, in hopes of helping test scores raise, with a separate teacher for each grade level, which they found to be not as effective as the set-up in 2004.

The conclusion of this literature review is that teaching low-ability students the basic skills they need to pass the standardized tests will increase their test scores. If students understand and are able to apply the basic concepts that were taught previously, then they will be more capable of using them in the real world as well as in future math classes. The low-ability students will be more successful and less frustrated than they had been previously, therefore gaining confidence in themselves as mathematicians. As a result, teachers will not need to spend as much time reviewing the basics or teaching to the tests. This progress will allow time to teach mathematics in a more exciting and more inspiring way while meeting the goals of the state and national standards.

CHAPTER III: METHODS AND PROCEDURES

Overview

All eighth grade students were given a Minnesota Basic Skills pre-test the first week of school in their regular math class. These scores were recorded by their math teacher, and then given to the researcher. The pre-determined low-ability support math (Target Math) students took notes and worked on basic skills worksheets for the entire first semester. Throughout the semester they were given other practice tests to compare their scores as well as figure out what strands they needed the most work on. A list of what each of the strands involves is provided in Appendix A. All eighth grade students took the Minnesota Basic Skills Test (MBST) in early February of 2005. A comparison from their pre-test scores to their actual Minnesota Basic Skills Test scores was taken in April of 2005.

Design

The problems that were found on the pre-test and the MBST were similar in content, since they both fit the requirements of the Minnesota State Standards. These problems were split by nine different strands of mathematics. A description of these strands can be found in Appendix A. This approach to gathering test data was in an effort to measure the growth both test subjects had made with basic skills throughout the first semester of the school year.

Selection of Test Subjects

The eighth grade Target Math students were selected based on their previous test scores and teacher recommendation. Target Math is typically based on students who are two or more grade levels behind in mathematics. The previous test scores

that were used were the Iowa Test of Basic Skills and the Stanford Test, both of which were taken in fifth and sixth grades respectively. The other sample of eighth grade students were randomly selected from the eighth grade math teachers class lists. The researcher numbered all the students, except for those in Target Math, and then pulled numbers out of a box to retrieve the names and test scores needed.

Measuring Devices

The measuring devices were a 2004 sample Math Basic Skills Test taken from the Minnesota Department of Education website that was given in September 2004 and the 2005 Minnesota Basic Skills Test (MBST) given in February 2005. All eighth grade students took the 2004 sample test sometime during the first week of school during their math class, and the math teachers graded and recorded the scores for their students. All eighth grade students took the MBST in February 2005 in the morning from 8:00 a.m. until 11:00 a.m. in their homeroom.

Validity Measures

“In statistics a **valid** measure is one which is measuring what it is supposed to measure. Validity refers to getting results that accurately reflect the concept being measured” (Wikipedia.org, 2006). In this study, the researcher was trying to test the significance of a support math class in helping to raise test scores. This study is valid in terms of its results, but there are a few threats that could have influenced the results.

The external threats to validity would include where and when the tests were taken, and who was teaching the test groups. The pre-test was taken at various times throughout the day in the math teachers’ classroom, while the MBST was taken in the

morning in the homeroom classroom. It is also possible that by the researcher teaching the study group and three other teachers teaching the control group, there would be some threat to validity due to differences in teaching styles.

The internal threats to validity include: loss of or gain of students, ethnicity and lower-abilities of the support group, and the students knowing that the MBST counted for more than the pre-test. Throughout the course of the study there were students from the support math group that were either removed from the school for behavior problems or taken out of the class because their parents did not want them in it anymore. There were also students who came into the support math class, but were not included in the study because they didn't have a pre-test score. The ethnicity of the support math group was quite diverse, in that there were about 60-70% minority students in that group, while the Caucasian students tended to be from families of low socio-economic status. All of the support math class students were at least two or more years below grade level, which could account for a higher jump in their scores. The last threat to internal validity would be the most important to note. All of the math teachers included the scores that the students received on their pre-test as part of their first quarter grade. The researcher believes, though, that having the students take the pre-test the first couple of days of school might not have been the best scores to take since most students have been on a mental break for two months, which could cause the scores to be quite low. Another threat to validity would be that the students know that if they do not pass the MBST, they do not graduate high school, which is a big motivator when taking that test.

Despite the few threats to validity, the t-test that was done with this data

shows a high probability that the hypothesis of this researcher was correct. Here is the summary of values taken from the website VassarStats.com:

Values	X _A (non-support group)	X _B (support math group)
N	60	54
Sum	357.29	1104.85
Mean	5.95	20.46
Sum squared	13491.85	65186.87
SS	11364.25	42581.43
Variance	192.61	803.42
Standard Deviance	13.88	28.34
Mean _A – Mean _B	T	Degrees of Freedom
-13.51	-3.52	112
Probability	One-tailed	0.000309
	Two-tailed	0.000618

According to StatPac.com, statistical significance is any data that has a probability of less than 0.001.

Reliability Measures

“In statistics **reliability** is the accuracy of the scores of a measure. Reliability does not imply validity. That is, a reliable measure is measuring something accurately, but not necessarily what it is supposed to be measuring” (Wikipedia.org, 2006). This study is not necessarily reliable, because the results will not necessarily be the same if done by another school or another researcher. Another teacher could

cause different scores for either of the study groups of students. The dynamics of the study group also cause this study to not be very reliable. The experience and attitude of the teacher teaching the support group could also cause the results to not be the same.

Field Procedures

W. James Popham believes that “a lot of today’s teachers also realize that by using some variation of a pretest/post-test data-gathering model, they can get an idea of how well they’ve taught” (2001). The support math class was taught by the researcher and they were given practice worksheets from the different strands off the Minnesota Basic Skills Test (MBST). They met every other day during the study hall period for a whole semester. All of the test subjects took the same eighth grade math class using the same math textbook, but they were all spread among three different math teachers.

The testing procedures were a little different for each of the tests given. The pre-test was taken at various times throughout the day in the math teachers’ classroom, while the MBST was taken in the morning in the homeroom classroom. The tests themselves were very similar, as they were both created by the Minnesota Department of Education.

Conclusion

Students were tested to see if they could raise their test scores on the Minnesota Basic Skills Test (MBST) after a semester of either support or no support. Since the MBST was given during the first week of school, the dependant variable was the growth the students made from the pre-test, assuming extra support or no

support. There were two measurements taken, and then the results were compared by using the percent increase.

As a researcher, it is not possible to control all of the variables that are created within an experiment. The diversity of the different groups, the time of day the tests were given, or the different teaching styles from the different teachers certainly affect the results of the students test scores. Despite all of those variables and others mentioned above, the percent increases taken from the student test scores would suggest the hypothesis to be true. A support math class every other day does help students increase their test scores on the Minnesota Basic Skills Test.

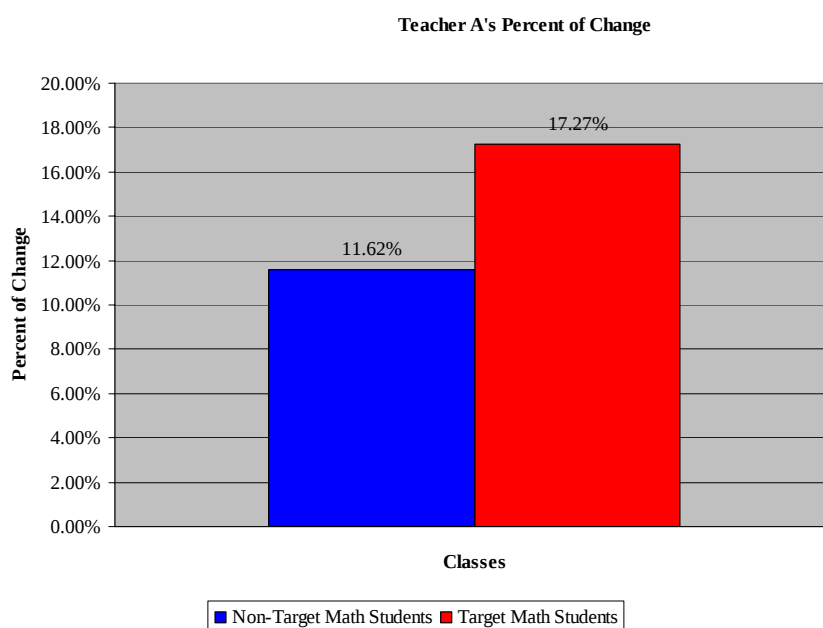
CHAPTER IV: RESULTS AND DISCUSSION

The researcher collected and compared data from the test group of eighth graders during the semester of the 2004-2005 school year. Two different measurements were taken to test if teaching low-ability students in a small support math class versus students not receiving the extra support will increase the test scores on the Minnesota Basic Skills Test (MBST). The students were given a pre-test on the first or second day of school in 2004, and then their results were compared to the scores they received on the MBST taken in February of 2005.

Results

The students were separated into three groups of two: three different math teachers, and then Target Math versus Non-Target Math. From there, the students were individually compared to the state standard of 75% passing rate. See Tables B1, B2, and B3 in Appendix B, as well as Figures 4.1, 4.2, and 4.3 below.

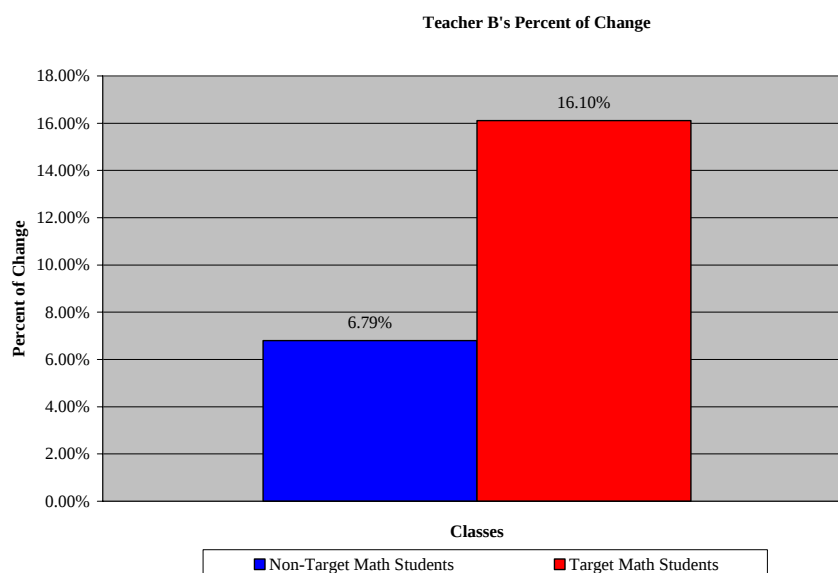
FIGURE 4.1: TEACHER A'S RESULTS



As shown in the table (Appendix B1) for Teacher A's group, there were two students whose scores were eliminated from the study, as they missed taking the pre-test. It was thought that they should still be included as part of the study group, but not in the final data. The data for this group is small because this teacher is a traveling teacher in the building where the data was collected and only teaches a couple of sections of eighth grade math. In looking at the data, it is noted that the Target Math students did better than the Non-Target Math students by a little more than 5%.

When a t-test was done with this group the probability was 0.1 for one-tailed and 0.2 for two-tailed, which means that this group's result is not significant by itself. It is too small of a group to make any significant conclusions.

FIGURE 4.2: TEACHER B'S RESULTS

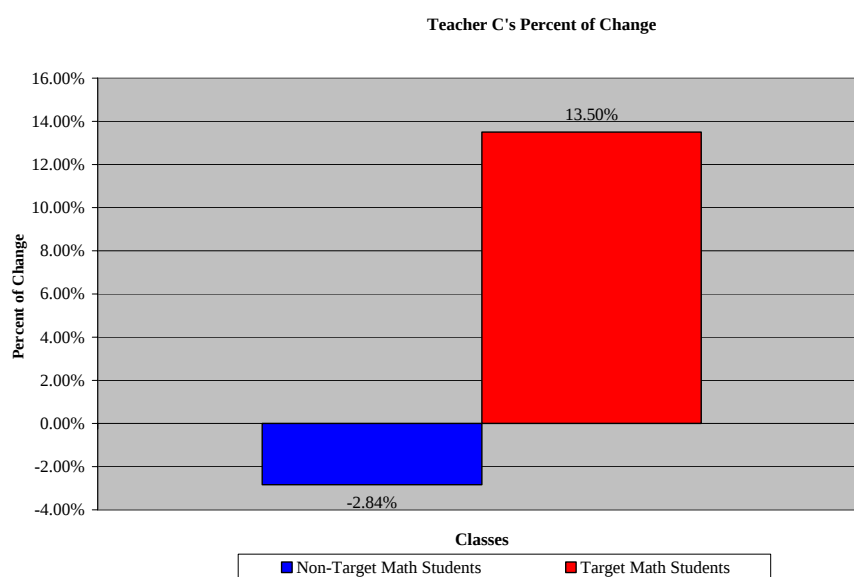


In Teacher B's data, there were four students whose scores were excluded because they missed either the pre-test or the MBST. This group is a larger set because this teacher had more math classes in the building than the previous teacher.

The Target math students for Teacher B had slightly more than a 9% increase over the Non-Target Math students. Even though this is a larger group, there was a more significant difference between Target Math and Non-Target Math than with Teacher A.

The t-test results for this group ended up with a probability of 0.03 for one-tailed and 0.06 for two-tailed, which is a little more significant. It shows that, again, the Target Math group had significant gain over the Non-Target Math group, but the data is not statistically strong enough to definitely prove the hypothesis.

FIGURE 4.3: TEACHER C'S RESULTS



Teacher C's group had no scores excluded, which was good for the validity of the study, but it also had some interesting comparisons between the two groups.

Again, the Target Math students did well and made a significant percent of increase. However, in looking at Table B3 (Appendix B), there are negative percents of change in the Non-Target Math columns. This allowed for the Target Math students to have slightly less than a 17% increase over the Non-Target Math students, which is highly

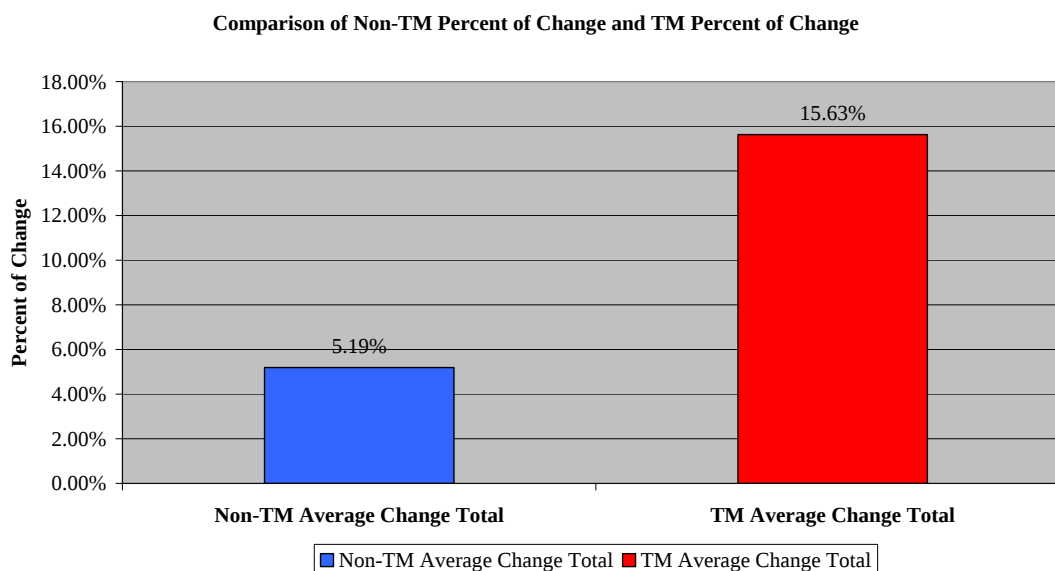
significant for this group of students.

In looking at the t-test results, the probabilities are significant with a one-tailed probability of 0.0025 and a two-tailed probability of 0.0051. Science would say this group alone could prove the hypothesis as correct, that a support math class every other day will help low-ability students raise their test scores on the Minnesota Basic Skills Test.

Discussion

The researcher chose to combine the total of each teacher's group results when doing the comparisons so that there would be a larger selection of students to compare. The t-test results are described above in the validity section of this research paper. It was found that the one-tailed probability was 0.000309 and the two-tailed probability was 0.000618, which are both highly significant in research and prove the hypothesis to be correct.

FIGURE 4.4: TARGET MATH VERSES NON-TARGET MATH



Again, the graphs show how well the Target Math students did compared to the Non-Target Math students. There was slightly higher than a 10% difference in the percent of increase made by the Target Math students versus the Non-Target Math students. In conclusion, it is shown that a support math class every other day will help low-ability students raise their test scores on the Minnesota Basic Skills Test more than students who do not receive the extra support.

CHAPTER V: SUMMARY AND CONCLUSIONS

Summary

W. James Popham (2001) states, “On statistical grounds alone, it is easier to elevate the performance of low-scoring students than it is to elevate the scores of any other groups of students.” This study confirms that opinion. The hypothesis was that a support math class every other day will help low-ability eighth graders raise their test scores on the Minnesota Basic Skills Test. According to the data retrieved, the hypothesis is correct, and it can be cited as significantly important based on the t-test probabilities found.

The students in the support math group were chosen based on their previous test scores showing they were two or more years below grade level. The other students were randomly selected from the three eighth grade math teachers’ class lists. All of the students were given a pre-test, taken from the Minnesota Department of Education website, the first week of school in their regular math classes. In February 2005, all of the students took the MBST in their homeroom classrooms in the morning. Both test scores were compared to get a percent of change for each student, and then those percents of change were averaged out for the different groups.

By allowing the low-ability students a smaller class size and an extra class to get help on their math skills, they gained the confidence needed to do math which could lead to a better understanding of the skills needed for life. Because they gained confidence throughout this experience, they will most likely do better in math in the future, assuming their educators continue to foster that confidence and offer more one-on-one support. One side observation was that because of the smaller, more

intimate class sizes, the students were more confident in asking questions or asking for help. This skill will assist them in all future studies, as the ability to ask for help will ensure guidance from future educators.

Conclusions

Post-study, the researcher talked with the three eighth grade math teachers, and we believed that Target Math was very successful in how it operates and its' ability to help raise test scores of the at-risk students without taking the time of all the students during the regular math class. Teacher A stated that he did nothing more than give MBST practice tests every few weeks in his regular math class, which means that the Target Math students received increased exposure to testing as well as the extra help from the Target Math teacher.

Teacher B stated that he required students to take online MBST practice tests and quizzes and they had to pass those quizzes and tests with an 80% or higher. His initiative in his regular classroom supported what the Target Math teacher was doing; but in looking at the data, the Target Math group still made more gains than his regular group of students. This again proves that the extra assistance made a difference in total scoring.

Teacher C stated that she did weekly Basic Skills Practice worksheets with her kids, but they were mainly on topics they were working with in class. She also gave several MBST practice tests throughout the semester to all of her students. It is possible that the random choice of her students selected the lower ability students which were more prevalent in her classroom due to the team configuration. This may give partial reason for the percent decrease in her non-Target Math scores.

In an environment of cuts and budget restraints, this study proves the importance of a Target Math class to help a school district increase their test scores. One wonders whether all students would benefit from smaller class sizes and more intentional curriculum. But, beyond the districts' and government's expectations and requirements, the Target Math students grew as people. From an educator's perspective, I took great pride in the Target Math students' growth.

Recommendations

One of the resources I used for the Target Math students were strand-based worksheets. These worksheets allowed me to focus on the students' weaknesses in a shortened time-period. By using the strand-based worksheets, it increased the students' own awareness of the test taking strategies and also increased the students' awareness of their own weaknesses. Stranding in regular classrooms may increase test scores across the board.

Another recommendation is that it might be helpful for other teachers to have a curriculum to use, which might eliminate the need for only one Target Math teacher in the building. If there was a curriculum, then other math teachers might feel more comfortable teaching the Target Math students. I found that it was easier for me to be the only Target Math teacher because it allowed me some flexibility in working with the other teachers, as well as working with the students. Knowing the curriculum allowed me to work ahead of the classroom teacher in teaching the low-ability students the concepts early to enhance their self-confidence in the regular math classroom.

Currently in my school, the department has made a change so that each math

teacher teaches their own students for Target Math. It has made things more difficult for me as a Target Math teacher, since it adds another preparation, as well as needing to focus differently for the students in my classroom. I have found it is a lot more difficult to stick to a curriculum or plan, and it is much easier to just allow the students to catch up on missing work or work on their homework. It may be more beneficial for the teachers and staffing, but I do not feel it is more beneficial to the students. My suggestion as a researcher is to not follow this set-up for a support math class, as I do not feel it will have made as significant gains as the year when there was only one Target Math teacher.

A suggestion was made during my presentation to look at the percent passing instead of the percent of change. I am not sure this would have shown the increases that I was looking for. I wanted to know if I could increase their MBST score- not necessarily get them to a passing score. Out of the students I had in Target Math, I had approximately 45% of them pass. It would have been difficult to find comparison groups for them, since most of the students who are not in Target Math are not at risk for failing the MBST, so they should have passed.

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APPENDICIES

Appendix A

Strands of the Mathematics Basic Standards Test

- A. Problem Solving: Whole Numbers, Fractions, Decimals and Integers** Solve real-life problems involving whole numbers, fractions, decimals and integers in a real-world context.
- B. Problem Solving: Percents, Rates, Ratios and Proportions** Solve real-life problems involving percents, rates, ratios and proportions.
- C. Number Sense, Place Value and Number Relationships** Use concepts of number sense, place value and number relationships to compare, order and determine equivalence of whole numbers, fractions, decimals, percents and integers.
- D. Estimation** Use estimation in the context of real-life problems. All items should represent contexts where most people would actually use estimation.

Calculators are not allowed on the estimation questions of the Basic Skills Test.

- E. Measurement Concepts** Apply measurement concepts to real-life problems.
- F. Tables and Graphs** Read, interpret and use one- and two-dimensional graphic forms such as tables, charts, maps and graphs to analyze data, identify patterns and make predictions.
- G. Chance and Data** Use elementary concepts of probability and statistics to solve problems.
- H. Shape and Space** Apply geometric and spatial relationships to solve problems in real-life.

Non-Calculator Computation Students will be required to compute answers without the use of a calculator. These items will be limited to one operation (addition, subtraction, multiplication, division), and will involve content from strands A and B (problem solving, whole numbers, fractions, decimals, integers, percents, ratios, and proportions).

Calculators are not allowed on the non-calculator computation questions of the Basic Skills Test

Appendix B

TABLE B1: TEACHER A'S SCORES

	<u>Pre-Test</u> <u>Scores</u>	<u>BST Scores</u>	Percent of Change		<u>Pre-Test</u> <u>Scores</u>	<u>BST Scores</u>	Percent of Change
				TM Student			
Student A	85	92	8.24%	A	57	60	5.26%
				TM Student			
Student B	72	93	29.17%	B	61	79	29.51%
				TM Student			
Student C	82	91	10.98%	C	79	88	11.39%
				TM Student			
Student D	88	96	9.09%	D	39	83	112.82%
				TM Student			
Student E	76	89	17.11%	E	n/a	60	n/a
				TM Student			
Student F	81	89	9.88%	F	85	97	14.12%
				TM Student			
Student G	84	84	0.00%	G	n/a	60	n/a
Averages	81.14285714	90.57142857	11.62%	Averages	64.2	75.28571429	17.27%

TABLE B2: TEACHER B'S SCORES

	<u>Pre-Test</u> <u>Scores</u>	<u>MBST</u> <u>Scores</u>	Percent of Change		<u>Pre-Test</u> <u>Scores</u>	<u>MBST</u> <u>Scores</u>	Percent of Change
Student A	99	100	1.01%	TM Student A	48	45	-6.25%
Student B	59	76	28.81%	TM Student B	49	29	-40.82%
Student C	95	95	0.00%	TM Student C	77	69	-10.39%
Student D	78	84	7.69%	TM Student D	57	71	24.56%
Student E	87	81	-6.90%	TM Student E	42	59	40.48%
Student F	86	95	10.47%	TM Student F	86	85	-1.16%
Student G	87	95	9.20%	TM Student G	49	64	30.61%
Student H	89	95	6.74%	TM Student H	72	88	22.22%
Student I	64	76	18.75%	TM Student I	54	68	25.93%

Support Math Class 37

Student J	85	93	9.41%	TM Student J	n/a	23	n/a
Student K	85	89	4.71%	TM Student K	n/a	51	n/a
Student L	88	97	10.23%	TM Student L	59	69	16.95%
Student M	88	91	3.41%	TM Student M	45	72	60.00%
Student N	78	76	-2.56%	TM Student N	61	63	3.28%
Student O	49	85	73.47%	TM Student O	70	87	24.29%
Student P	88	96	9.09%	TM Student P	87	87	0.00%
Student Q	81	92	13.58%	TM Student Q	76	55	-27.63%
Student R	70	84	20.00%	TM Student R	40	69	72.50%
Student S	76	79	3.95%	TM Student S	38	n/a	n/a
Student T	91	88	-3.30%	TM Student T	58	65	12.07%
Student U	87	92	5.75%	TM Student U	67	89	32.84%
Student V	88	95	7.95%	TM Student V	55	67	21.82%
Student W	81	89	9.88%	TM Student W	37	n/a	n/a
Student X	85	95	11.76%	TM Student X	62	69	11.29%
Student Y	92	73	-20.65%	TM Student Y	64	72	12.50%
Student Z	87	93	6.90%	TM Student Z	61	81	32.79%
				TM Student			
Student AA	92	92	0.00%	AA	69	87	26.09%
				TM Student			
Student BB	90	80	-11.11%	BB	64	85	32.81%
				TM Student			
Student CC	78	84	7.69%	CC	60	63	5.00%
				TM Student			
Student DD	76	83	9.21%	DD	60	93	55.00%
				TM Student			
Student EE	85	93	9.41%	EE	61	85	39.34%
				TM Student			
Student FF	67	88	31.34%	FF	79	81	2.53%
				TM Student			
Student GG	79	89	12.66%	GG	62	81	30.65%
				TM Student			
Student HH	82	97	18.29%	HH	56	63	12.50%
Averages	82.89	88.53	6.79%	Averages	60.16	69.84	16.10%

TABLE B3: TEACHER C'S SCORES

	<u>Pre-Test</u>	<u>MBST</u>	Percent of		<u>Pre-Test</u>	<u>MBST</u>	Percent of
	<u>Scores</u>	<u>Scores</u>	Change		<u>Scores</u>	<u>Scores</u>	Change
Student A	88	78	-11.36%	TM Student A	74.6	75	0.54%
Student B	88	81	-7.95%	TM Student B	69	78	13.04%
Student C	77	79	2.60%	TM Student C	65.7	75.7	15.22%
Student D	73	80.6	10.41%	TM Student D	33.6	70.8	110.71%
Student E	87	86	-1.15%	TM Student E	78	82	5.13%
Student F	82	100	21.95%	TM Student F	84	73	-13.10%
Student G	85	84.5	-0.59%	TM Student G	69.2	75	8.38%
Student H	71	74.5	4.93%	TM Student H	47	77.5	64.89%
Student I	95	84.6	-10.95%	TM Student I	70	82	17.14%
Student J	88	86	-2.27%	TM Student J	49	69	40.82%
Student K	100	84.5	-15.50%	TM Student K	47	69.6	48.09%
Student L	82	78	-4.88%	TM Student L	64	72	12.50%
Student M	96	84.5	-11.98%	TM Student M	59.7	72.6	21.61%
Student N	88.1	82	-6.92%	TM Student N	88	66	-25.00%
Student O	87	88	1.15%	TM Student O	76	78	2.63%
Student P	90	84.5	-6.11%	TM Student P	60	77	28.33%
Student Q	77	76	-1.30%	TM Student Q	70	73	4.29%
Student R	83	77.5	-6.63%	TM Student R	82	75.7	-7.68%
Student S	79	81	2.53%	TM Student S	58	71	22.41%
Averages	85.06	82.64	-2.84%	Averages	65.52	74.36	13.50%

WILL GRADUAL MOVEMENT FROM EXTRINSIC TO INTRINSIC
REINFORCERS DECREASE A STUDENT'S DEPENDENCE ON EXTRINSIC
REWARDS?

by

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B.S. Mount Marty College, Yankton, SD 1999

A capstone submitted to the Faculty of Graduate School of Winona State University

in partial fulfillment of the requirement for the degree of

Master of Science

Department of Education

April 2006

This capstone entitled:

WILL GRADUAL MOVEMENT FROM EXTRINSIC TO INTRINSIC
REINFORCERS DECREASE A STUDENT'S DEPENDENCE ON EXTRINSIC
REWARDS?

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The final capstone has been examined by the signatories, and we find that both the content and the form meet acceptable presentation standards of scholarly work in the above mentioned discipline.

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WILL GRADUAL MOVEMENT FROM EXTRINSIC TO INTRINSIC REINFORCERS DECREASE A STUDENT'S DEPENDENCE ON EXTRINSIC REWARDS?

Capstone directed by Dr. Thomas Sherman, Ph. D.

ABSTRACT

There is no reason to offer contingent reinforcement if students already perform without it. Teachers should not provide more reinforcement than necessary to accomplish desirable behavior changes. When teachers use contingency reinforcement, they should build in procedures to help maintain improvements over time and to encourage self-management. This study explored the effects of a 7th grade student with a Developmental Cognitive Disability (DCD) and how gradually reducing his dependence on extrinsic reinforcement by reducing the frequency and by moving from extrinsic to intrinsic reinforcers worked to encourage self-management.

For thirty weeks, a student with a Developmental Cognitive Disability was observed on how extrinsic and intrinsic reinforcers affected his progress toward behavior goals. The student was monitored throughout this time frame to document any changes that were made in behavior and progress toward Individualized Interagency Intervention Plan (IIIP) goals.

Within the thirty weeks that this study was conducted, it was determined that the gradual fading of extrinsic rewards to intrinsic rewards was effective in maintaining student progress and decreased dependence on extrinsic rewards.

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INTRODUCTION

CHAPTER I

Among leading concerns for every educator is the question of how to motivate students. Some students enter the classroom ready and willing to work, follow directions, are eager to learn, and are constrained by time only. Others appear completely disinterested and must virtually be bribed to accomplish an acceptable level of learning or appropriate classroom behavior. To maintain social order in your classroom and school environment and to ensure that students master behavioral objectives, it is sometimes necessary to offer extrinsic motivators. Professional literature indicates there is no need to reward behavior that students engage in routinely without reinforcement, and such reinforcement may actually undermine their intrinsic motivation. However, it is not unreasonable to reward students for behavior they would not otherwise perform. Two methods for reducing dependency on extrinsic reinforcement are called fading and thinning. This study explored the effects of how fading and thinning extrinsic rewards reduced a 7th grade special education student's dependence on rewards and encouraged intrinsic motivation.

Need for Study

Some special education students need specific consequences and rewards to teach them to change or demonstrate desirable behaviors. When a teacher's efforts to encourage a student's intrinsic motivation in the classroom have not worked, individual contingency management is an option. However, as suggested by contingency plan research, procedures should be built in to help maintain improvements over time and to encourage intrinsic motivation. Gradually reducing the student's dependence on extrinsic

reinforcement by reducing the frequency or by moving from extrinsic to intrinsic reinforcers can help students reinforce their own performance and decrease dependence on external rewards.

Allen & Citron (1990), expressed concerns regarding the rights of children as research subjects and suggested observational and descriptive research as a less obtrusive means for studying children. This study will follow those suggestions.

Statement of Problem

Efforts to encourage a specific student's intrinsic motivation in the classroom have not been effective. A contingency plan has been developed with specific rewards to teach desired behaviors. Will reducing the student's dependency and frequency on extrinsic reinforcement be effective? Will the student be able to reinforce their own performance and stop depending on external rewards?

Statement of Question to Drive the Inquiry

Will gradually reducing a student's dependence on extrinsic reinforcement by reducing the frequency and by moving from extrinsic to intrinsic reinforcers decrease dependence on extrinsic rewards?

Definition of Terms

Annual Goals: Statements, which are derived from the student's needs that describe what students with disabilities can reasonably be expected to accomplish within a year.

Behavior Chart: A method used to document progress made towards IEP objectives.

Behavior Management: All methods used to enhance the probability that people, individually and in groups, choose behaviors, which are personally fulfilling, productive, and socially acceptable.

Case Manager: A special education teacher who coordinates and manages all special education issues related to a particular student assigned to them.

Contingency Management (Plan): Systematically arranging consequences to modify behavior.

Developmental Cognitive Disability: A condition resulting in significantly below average intellectual functioning and concurrent deficits in adaptive behavior that adversely affects educational performance.

Extrinsic Motivation: Motivation to engage in an activity as a means to an end. Individuals who are extrinsically motivated work on tasks because they believe that participation will result in desirable outcomes such as a reward or avoidance of punishment.

Fading: Gradually reducing the student's dependence on extrinsic reinforcement by moving to more internalized reinforcement (i.e. praise).

Individuals with Disabilities Education Improvement Act of 2004 (IDEA '04): Federal law that mandates every child in the United States who has a disability and needs special education, is entitled to a free appropriate public education (FAPE). The law works to improve results for infants, toddlers, children and youth with disabilities. The five major components of IDEA are

evaluation and identification, Individualized Education Program and Related Services, Placement, Funding and Procedural Safeguards.

Individualized Education Plan (IEP): A written document that describes a child's educational needs and details the special education and related services the educational institution will be providing to address those needs.

Individualized Interagency Intervention Plan (IIIP): A standardized written plan describing those programs or services and accompanying funding sources available to children with disabilities.

Intrinsic Motivation: Refers to motivation to engage in an activity for its own sake. People who are intrinsically motivated work on tasks because they find them enjoyable.

Mainstream Environment (Classroom): A regular education classroom that provides a general education curriculum to predominantly non-special education students.

Objectives: Measurable steps between a student's present level of performance and the annual goal target.

Progress: A student's positive movement toward a goal.

Progress Reports: A means of documenting and communicating a student's progress toward a goal.

Resource Room: A special education classroom that provides individualized instruction to students who qualify for special education services.

Special education services: Specially designed instruction that meets the unique needs of a child.

Thinning: Gradually reducing the frequency (or schedule) of reinforcement.

Variables

Independent Variables

The independent variables in this study are the contingency plan rewards.

Rewards for demonstrating the desired behaviors will change from tangible reinforcers to social reinforcers to self-reinforcement.

Dependent Variables

The contingency plan behaviors and weekly goal will be affected by the contingency plan rewards. Behaviors include: Being on time to class, having the proper materials for class, following directions, talking in a seventh grade voice, and expressing feelings when asked.

Control Variables

The student involved in the contingency plan, contingency plan behaviors, special education teacher, paraprofessionals working with the student, seventh grade teachers.

Moderator Variables

Some classes will change throughout the course of the year affecting the time of day the student has certain classes.

Limitations (Delimitations) of the Study

The study will be conducted with only one student. Therefore, statistical data will not be related to a group of students.

REVIEW OF RELATED LITERATURE

CHAPTER II

Research shows that properly designed reward programs enhance intrinsic motivation by providing positive feedback about student achievement. This can be especially important to disadvantaged students because it helps them achieve educational equality. When properly used, rewards motivate students with no harmful effects. Rewards are particularly helpful at the beginning stages of skill development to jumpstart a child's interest. Once a child becomes more expert at a skill, rewards are less necessary because the practice of the skill itself then becomes more intrinsically motivating. Institute for Academic Excellence, Inc. (1997).

Because of human complexity, there is more than one way to motivate learning. In fact, a host of psychological theories, models, methods and factors have been suggested, tested and used at various times and in various settings. However, these numerous motivational approaches can be categorized into two broad groups, extrinsic and intrinsic motivation. Bomia, Beluzo, Demeester, et al. (1997).

Extrinsic motivation is an incentive that is not part of an activity: it is motivation that comes from outside. Examples of these outside sources are rewards; positive or negative outcomes, and comfort or discomfort. Institute for Academic Excellence, Inc. (1997). Extrinsic motivation theory sees humans as naturally passively involved with their environment. This type of individual performs tasks or exhibits behavior in order to get a reward or comply with some external constraint, rather than to satisfy personal challenge with respect to controlling their environment. Ingram. (2000).

The idea of control is also of significance in understanding the implications of extrinsic motivation that we prefer and engage more readily in those activities we feel to be freely chosen, because we prefer to control ourselves rather than to be controlled. The offer of a reward is an external control over our behavior, therefore decreasing both interest and pleasure. Although we may accept the condition temporarily by working for the reward, we are less likely to engage in the activity voluntarily and less likely to enjoy the activity when the reward is withdrawn. There is also evidence to suggest that the quality of what is produced as a result of the activity may decline when a reward contingency is present. Hilker. (1993).

Intrinsic motivation is the desire to do something for its own sake. Intrinsic motivation is said to come from within, it's the pleasure we get, for example, in doing something well or losing ourselves in a task. Dev. (1996). The idea of intrinsic motivation focuses on the need and capacity of individuals to interact effectively with their environment. People engage in particular behaviors within the environment in order to feel a sense of competence and self-determination. Each individual's "motivational mechanism" will lead that person naturally to situations that provide appropriate challenges for optimum use of abilities. Intrinsic motivation views humans as organisms actively involved with their environments such that they can themselves bring about a certain rewarding inner state. Hilker. (1993).

Research says that intrinsic and extrinsic motivation actually constitutes a continuum. They relate so closely that they are almost inseparable. Since teachers seek to motivate students to learn, they can use strategies that utilize either or both extrinsic and intrinsic motivation. "When incentives are linked to the desired behavior and

promote engagement in the desired behavior, motivation can become self-determined and can foster high-quality learning”. Institute for Academic Excellence, Inc. (1997).

Ultimately, the classroom educator must determine what types of motivators will benefit his or her students. The cause of excellence in education, and of a more just society, is best served by a balanced approach toward learning motivation that supports the professional judgment of classroom teachers (Institute for Academic Excellence, 1997).

METHODS AND PROCEDURES

CHAPTER III

Overview

This study explored how a student with a Developmental Cognitive Disability was affected by the implementation of a contingency plan to improve behavior in the following areas: being on time to class, having the proper materials for class, following directions, talking in a seventh grade voice and talking about feelings when angry or upset. The student was responsible for carrying a behavior sheet to all of his classes for thirty weeks. If the student was able to demonstrate all five behaviors during a class period he received a green sticker on his behavior sheet from the teacher or paraprofessional working with him. If one or more of the behaviors was not demonstrated, the student received a red sticker on his behavior sheet. At the conclusion of each day the student would record his daily progress on a chart in the resource room. It was possible for the student to receive eight green stickers, one for each class period of the day. For the first ten weeks of the plan, the students' weekly goal was to average thirty green stickers (out of a possible forty) per week or six per day. If the goal was achieved, the student was allowed to choose a reward from the "prize bag".

At week eleven, the goal for the student was raised to average thirty-five green stickers per week or seven per day. The reward for the student was also slightly changed and the student was not able to choose any reward he wanted from the "prize bag". If the goal was attained the student was able to spin a "spinner" and receive one of six different rewards. The rewards included: candy, panther pride tickets, prize bag, magic envelope, internet privileges, and time to watch a movie.

This goal and reward method continued through week fifteen of the plan. Week sixteen through twenty, the student reward was once again slightly altered. Although, the goal of receiving thirty-five green stickers per week remained the same, the rewards on the “spinner” were changed. The rewards included: lunch with a friend, panther pride ticket, game-time with a friend, and no prize.

The final ten weeks of the plan (weeks twenty-one through thirty) the goal of averaging thirty-five green stickers remained the same and once again the reward schedule was changed. The student no longer received extrinsic rewards. The focus was to encourage self-management and to help the student feel a sense of accomplishment when he attained his goal. The students’ parents, teachers and principal were informed when his goal was met. The reward became praise, a high-five, or a pat on the back from this group of people.

The objective of the study was to show that by gradually reducing a student’s dependence on extrinsic reinforcement by reducing the frequency and by moving from extrinsic to intrinsic reinforcers, this would decrease dependence on extrinsic rewards.

Subject

This study was based on one student in grade seven who has met criteria for the Developmental Cognitive Disabilities program. This student has been receiving special education services since his early childhood years. He is currently receiving special education services through the developmental cognitive disabilities program, speech/language program, and developmental/adaptive physical education program. Records indicate that the student has a diagnosis of cerebral palsy, fetal alcohol

syndrome, and also has a seizure disorder. When the student was last evaluated he earned a full scale IQ of 50. The subject lives with his father, stepmother, younger brother and younger sister.

Research Design

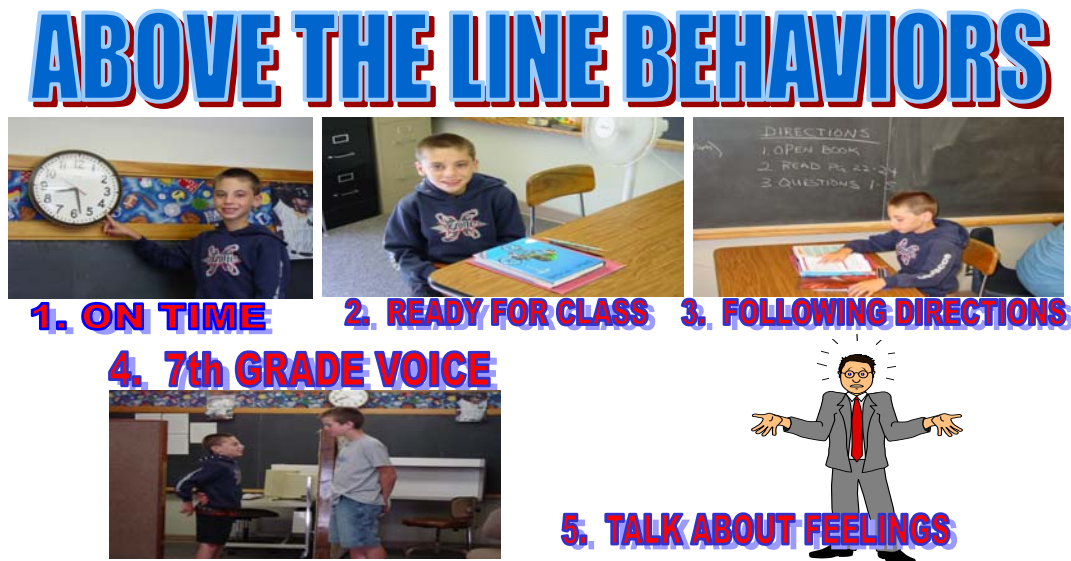
The student involved throughout this study was enrolled in a school district in southeastern Minnesota. The student received special education services from the same instructor for an average of 165 minutes per day each week. During this time on Mondays, the student would review the five behaviors that he needed to demonstrate to be successful. The student graphed his progress daily before he left school and reflected on what was illustrated by the chart. An overall weekly average was calculated, which would determine if the student has reached his goal for the week. If the goal was reached, the student would receive his reward. If the goal was not reached, the student would discuss the ways he could improve his performance/behavior for the following week.

Instruments/ Measuring Devices

The contingency plan was created at the student's IIIP meeting with input from the student, parents, teachers, school psychologist, special education coordinator, guidance counselor, social worker and middle school principal. At the beginning of the study the student helped to create a poster which represented the "Above the Line Behaviors" (appropriate behaviors) and "Below the Line Behaviors" (inappropriate behaviors). This poster was displayed in the resource room as a visual reminder to the

student. Smaller copies of the poster were given to each of the students' teachers to use as visual cue if needed (see Figure 1.1). The special education instructor created a behavior sheet for the student to take each of his classes (see Figure 1.2). The classroom teacher, special education teacher, or paraprofessional gave the student a green sticker or red sticker based on the student's performance each class period. The behavior sheet also allowed teachers or paraprofessionals to make comments in regards to each class period. The student took the behavior sheet home daily and returned it the next day with a parent's signature. The special education instructor created a ten week behavior chart to record the student's progress (see Figure 1.3). The student would record his progress daily on this chart. This chart was displayed in the resource room to allow the student to reflect on what was illustrated by the chart. At the end of each week the weekly average was totaled to see if the behavioral goal had been attained. Using this information, progress reports were created by the instructor and information was sent home weekly in regards to the student's progress.

Figure 1.1



Validity Measures

As the student experienced various life stressors and changes in schedule, his behavior was directly impacted. General education teachers and paraprofessionals participated in completing the student's behavior sheet daily. Overall, the student's behavior progress was obtained over a thirty week time interval successfully. In reference to reporting accurate progress, this procedure is an invalid method as teachers report their perceptions of the student's behavior in the classroom.

Reliability Measures

Although different teachers or paraprofessionals interpreted the behaviors, the educators that participated in the study had consistent individual perceptions of the classroom behaviors. The classroom teachers and/or paraprofessionals recorded their observations on the behavior sheet and each behavior sheet was recorded and calculated into a weekly average. Since the interpretations were subjective, reliability could have been influenced by these outside factors and may have affected the results of the study.

Procedures

To complete this study all behavioral goals needed to be observable and measurable. A behavior sheet was made for the student. The behavior sheet included a place for the date; it listed all of the student's classes, a space for comments from teachers, and a section for a green or red sticker to be placed for each class period. Each morning the behavior sheet was picked up by the student in the resource room. The student carried the sheet with him to all of his classes. At the end of each class period,

the teacher or paraprofessional would place a green or red sticker to signify whether or not the student demonstrated the behavioral objectives for the 50 minute class period. The teacher or paraprofessional could also make a comment in the space provided in regards to the behavior.

A behavior chart was constructed for the student and posted in the resource room. The behavior chart included all of the classes the student was enrolled in and spaces to record behavior goals daily. The chart represented ten weeks of behavioral progress. Each day before school ended the student used his behavior sheet to record data onto the behavior chart. The student used a green or red marker to mark each class period on the chart. On Friday, the data was calculated and a weekly average was found. The student had a brief discussion with the special education teacher concerning the positive areas and areas that need improvement.

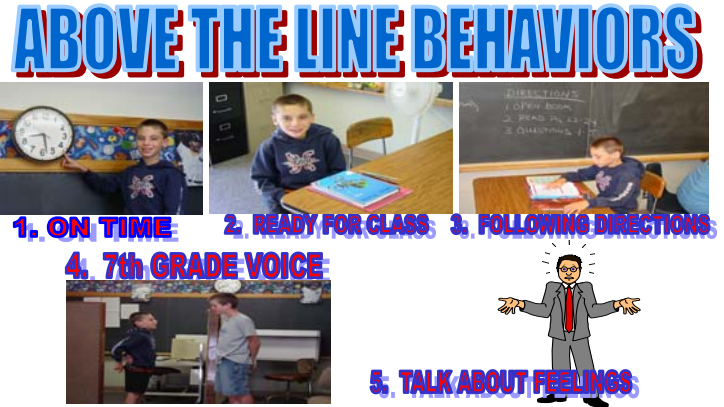
Conclusion

A contingency plan was developed with specific rewards to teach desired behaviors. Once the desired behaviors were learned, fading and thinning techniques were used effectively to decrease the student's dependence on extrinsic rewards. Intrinsic reinforcers were built into the plan to encourage self-management by the student. It was determined that the gradual fading and thinning of extrinsic rewards to intrinsic rewards was effective in maintaining student progress.

RESULTS AND DISCUSSION

CHAPTER IV

For this study, the researcher spent thirty weeks observing a student with a Developmental Cognitive Disability. During this time five measurable behaviors were identified: getting to class on time, following directions, talking in a seventh grade voice, bringing the proper materials to class, and expressing feelings when angered. A behavior



sheet was created for this student. The student carried the behavior sheet with him from class to class.

Date:		
Reading/ English		
Science		
Social Skills		
JOB		
PE/Target		
Math		
Exploratory		
Choir/ Target		
Comments:		

At the end of each class period, the student would receive a red or green sticker from the teacher or paraprofessional. The red sticker signified that the student did not demonstrate adequate behavior in one of the five behaviors during that class period. A green sticker signified that the student did in fact demonstrate adequate behavior in each

of the five behaviors during that class period. At the end of each day the student would record his totals on a behavior chart hung in the resource room. For the first ten weeks of the plan, the student's weekly goal was to average thirty green stickers per week or six per day. If the goal was achieved, the student was allowed to choose a reward from the "prize bag".

At week eleven, the goal for the student was raised to average thirty-five green stickers per week or seven per day. The reward for the student was also slightly changed and the student was not able to choose any reward he wanted from the "prize bag". If the goal was attained the student was able to spin a "spinner" and receive one of six different rewards. The rewards included: candy, panther pride tickets, prize bag, magic envelope, internet privileges, and time to watch a movie.

This goal and reward method continued through week fifteen of the plan. Week sixteen through twenty, the student reward was once again slightly altered. Although, the goal of receiving thirty-five green stickers per week remained the same, the rewards on the "spinner" were changed. The rewards included: lunch with a friend, panther pride ticket, game-time with a friend, and no prize.

The final ten weeks of the plan (weeks twenty-one through thirty) the goal of averaging thirty-five green stickers remained the same and once again the reward schedule was changed. The student no longer received extrinsic rewards. The focus was to encourage self-management and to help the student feel a sense of accomplishment when he attained his goal. The student's parents, teachers and principal were informed when his goal was met. The reward became praise, a high-five, or a pat on the back from this group of people.

Data:

The behavior charts below display thirty weeks of data indicating whether or not the student reached his behavior goal for the week.

<u>Class</u>	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Reading/English										
Science										
Social Skills										
JOB										
PE/Target										
Math										
Exploratory										
Target/Choir										
GOAL: 30 GREEN DOTS PER WEEK	GOAL MET- 37	GOAL MET- 36	GOAL MET- 35	GOAL MET- 30 Average	GOAL MET- 39	GOAL MET- 31	GOAL MET- 38	GOAL MET- 30	GOAL MET- 35 Average	GOAL MET- 35

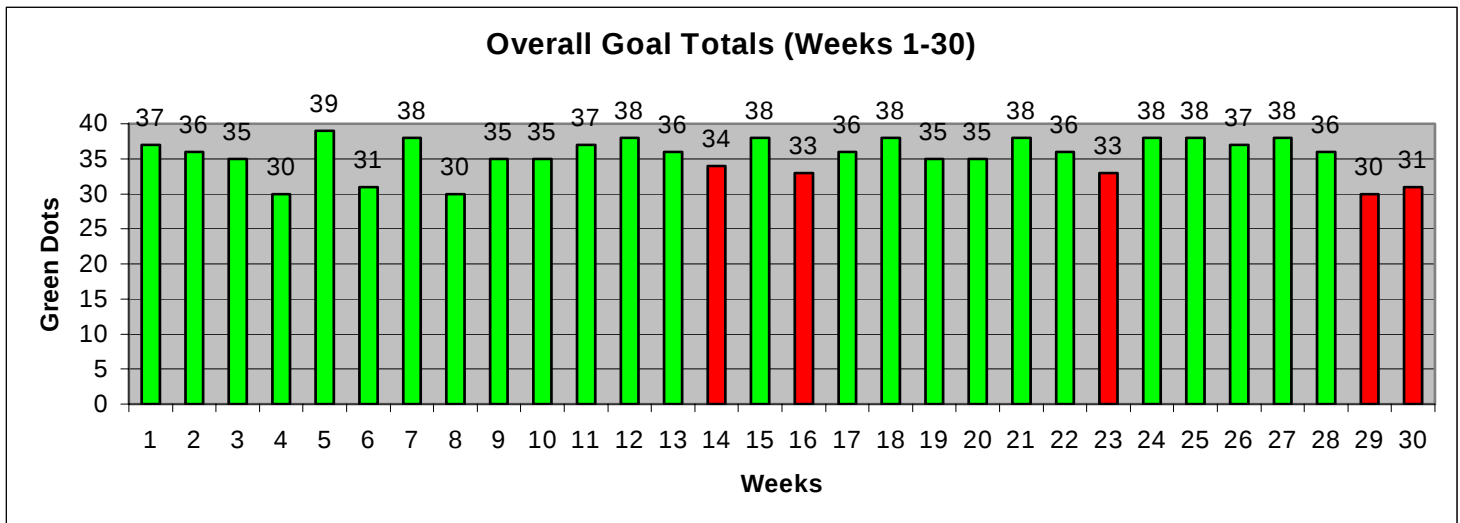
<u>Class</u>	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17	Week 18	Week 19	Week 20
Reading/English										
Science										
Social Skills										
JOB										
PE/Target										
Math										
Exploratory										
Target/Choir										
GOAL: 35 GREEN DOTS PER WEEK	GOAL MET- 37	GOAL MET- 38	GOAL MET- 36	GOAL NOT MET- 34	GOAL MET- 38	GOAL NOT MET- 33	GOAL MET- 36	GOAL MET- 38	GOAL MET- 35	GOAL MET- 35

<i>Class</i>	Week 21	Week 22	Week 23	Week 24	Week 25	Week 26	Week 27	Week 28	Week 29	Week 30
Reading/English										
Science										
Social Skills										
JOB										
PE/Target										
Math										
Exploratory										
Target/Choir										
GOAL: 35 GREEN DOTS PER WEEK	GOAL MET- 38	GOAL MET- 36	GOAL NOT MET-33	GOAL MET- 38	GOAL MET- 38	GOAL MET- 37	GOAL MET- 38	GOAL MET- 36	GOAL NOT MET- 30	GOAL NOT MET- 31

The behavior charts above include all of the classes the student was enrolled in and have spaces to record behavior goals daily for each class. The charts represent thirty weeks of behavioral progress. At the conclusion of each school day the student used his behavior sheet to record data onto the behavior charts. The student used a green or red marker to mark each class period on the chart. If behavior goals were met for the class period, the student earned a green mark. If behavior goals were not met for the class period, the student earned a red mark. On Friday, the data was calculated and a weekly average was found. The student had a brief discussion with the special education teacher concerning the positive areas and areas that needed improvement.

In weeks 1-10, the student's behavior goal was to attain 30 green dots per week. If the goal was attained he was rewarded with an extrinsic reward. The student was

successful ten out of ten weeks in attaining the average of 30 green dots per week in weeks 1-10. In weeks 11-15, the student's goal was raised to 35 green dots per week and the reward was limited to six specific extrinsic rewards, determined by spinning a "spinner". The student reached his goal four out of the five weeks. Weeks 16-20, the goal remained 35 green dots, but the reward was limited to a possibility of three extrinsic rewards and a chance of receiving no reward, determined by "spinner". The student was successful reaching his goal four out of five weeks. The final weeks (21-30), the goal remained 35 green dots and the extrinsic rewards were completely faded out. The reward became praise, a high-five, or a pat on the back. The student was successful reaching his behavior goal in seven out of ten weeks.



The graph above represents 30 weeks of data collection and how many green dots the student achieved each week. The green bars represent weeks that the student met his weekly behavior goal. The red bars represent weeks that the student did not meet his behavior goal. Although, it appears the student's behavior declined in weeks 14-30, this

is slightly misleading. In weeks one through ten the student's goal was 30 green dots instead of 35 as it is in weeks 11-30. The behavior goal was raised after 10 weeks to challenge and push the student. Also, it is important to note that in four out of the five weeks the student did not meet his goal, it was not a typical five-day school week. Weeks 16 and 23 were only four days. The student's schedule was altered and may have caused some confusion or frustration. Weeks 29 and 30 were the last two weeks of school and there were many schedule and routine changes. Therefore, although the data did not show a continuous incline, progress was made and the student was motivated to improve his behaviors.

SUMMARY AND CONCLUSION CHAPTER V

This study explored the effects of a 7th grade student with a Developmental Cognitive Disability (DCD) and how gradually reducing his dependence on extrinsic reinforcement by reducing the frequency and by moving from extrinsic to intrinsic reinforcers worked to encourage self-management.

For thirty weeks, a student with a Developmental Cognitive Disability was observed on how extrinsic and intrinsic reinforcers affected his progress toward behavior goals. The student was monitored throughout this time frame to document any changes that were made in behavior and progress toward IIP goals.

A contingency plan was developed with specific rewards to teach desired behaviors. Once the desired behaviors were learned, fading and thinning techniques were used effectively to decrease the student's dependence on extrinsic rewards. Intrinsic reinforcers were built into the plan to encourage self-management by the student. The data collected was measurable and easy to comprehend. The behavior charts provided an excellent visual for the student to evaluate his performance in each of his classes. It was determined that within thirty weeks the gradual fading and thinning of extrinsic rewards to intrinsic rewards was effective in maintaining student progress and decreased dependence on extrinsic rewards.

Recommendations

When discussing this study with colleagues and based on the judgment of the researcher, it may have been better to keep the goal for attaining green dots per week the same during all weeks. This would have given a better visual when interpreting the

overall behavior chart. The researcher would continue to use this method as a means for collecting data, motivating challenging students, and for increasing student awareness of behavior expectations.

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DOES THE USE OF FLASH CARDS INCREASE COMPREHENSION AND
RETENTION OF VOCABULARY TERMS FOR MIDDLE SCHOOL SCIENCE
STUDENTS?

By

John W. Rud

B. S. Winona State University, 2000

A capstone submitted to the faculty of the Graduate School of Winona Stat
University

In partial fulfillment of the requirement for the degree of

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Does the use of flashcards increase comprehension and retention of vocabulary terms for middle school science students?

Capstone directed by Dr. Thomas Sherman

Abstract

The reality in public education today, is that testing is the measure by which our school systems are being judged. Schools today must meet adequate yearly progress and the test scores of the students in the schools determine the success of this progress. The No Child Left Behind Act is the driving force behind these changes. In the recent past most of the emphasis for testing and improvement has been placed on reading and math with science being overlooked. The state of Minnesota is just now in the process of testing students in science. The future demands that educators do everything that they can to increase test scores of all students in all areas of study. The No Child Left Behind Act demands that schools work for continuous improvement and that all students receive a high quality education. Every student will have to pass a state science test to be allowed to graduate from high school.

The students in this study were all divided into four groups. They all received identical sets of lessons and these lessons were taught in the same manner and in the same amount of time for each group of students. A direct instruction technique, the use of flashcards was applied to all of the four groups of 8th grade science students. The Earth Science unit used in this study was rocks and minerals. The first group of students in this study are the control group and they received the unit of study in the method that it was previously taught to other groups of students without any modifications or changes.

Two of the groups of students made and used flashcards that contained only the vocabulary words on the front side of the cards and the definitions for each of the vocabulary words on the back side. The final group of students created and used flashcards that contained the vocabulary words and pictures, drawn by the student, on the front of each flashcard and the definitions of each word written on the back. The direct instruction strategies used with flashcards in this study tested the value in the use of flashcards to increase vocabulary and retention of vocabulary terms. This study also tested the value of different types of flashcards in teaching vocabulary. Each group of students in this study were tested with a pretest to determine the entry level of knowledge and post tested to determine the exit level of knowledge of this unit. The test scores of each of the four groups of students were compared to each other.

There was a significant increase in test scores through the use of direct instruction. The level of increase in test scores directly corresponded to the use of flashcards. The level of test score increase was greater in the group of students that used pictures along with definitions on the flashcards. An increase in student participation and the use of science vocabulary in the classroom was observed during this study. Direct instruction has affected an increase in the mastery of curriculum being taught. The increase in test scores also varied with respect to the reading level of the students. The students with a higher reading level showed a greater level of increase than the students that preformed at a lower reading level. This study shows that flashcards as a direct instruction technique has merit.

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CHAPTER 1: INTRODUCTION

Need for the study:

Accountability in public education is the political hot topic of the day. In most schools today test results are being used to set budgets, assess school performance, and judge our teachers. With the No Child Left Behind Act and the State Standards that have been put into use, the need to prepare students to pass standardized tests has placed tremendous pressure on the teachers and the public education system. The state continues to develop more tests for students to take at all grade levels. In 2007 all 8th grade students, in Minnesota, will be required to take an assessment test in Science for the first time. Schools that fail to meet the criteria for making adequate yearly progress are being cited. In order for the schools to avoid being cited, the students need to show adequate progress on the tests that the state has deemed mandatory.

Statement of the problem:

Students all have a different set of background experiences, and from this their knowledge base was developed. The basic education that each student has received also varies between individuals. The state has placed an emphasis on math and reading, while science has not received as much attention. In Interviews with Rochester Elementary classroom teachers Rebecca Johnson, Linda Rud, speech clinician Sandy Naylor, LD teacher Carrie Miller, and ESOL teacher Junelle Henensted, I found that students in the elementary grades that require special classes are often removed from science classes to receive this special instruction. This practice

is reversed once the students reach middle school. At this time, these students are placed into science classes because they tend to be more of a hands-on environment. This has increased the differences in the range of abilities of students in middle school science classes.

The increased use of technology by students and society today has decreased the amount of time that students spend reading. This has created a population of students that have vocabularies that are smaller than the vocabularies that students may have had in the past. The methods used to obtain information are much different today than they were in the past.

Middle school science curriculum contains a great deal of vocabulary that the student has not experienced before. Each unit of study is unique in the vocabulary required for student comprehension. Students have difficulty retaining and comprehending new material when they don't have a good understanding of the reading material that is part of each unit of study. For students to understand the concepts of science they need to fully comprehend the vocabulary. There is more to understanding vocabulary than just memorizing the terms.

Purpose of the Study:

The purpose of this study is to determine the extent that the use of flash cards of content vocabulary terms by eight grade science students improves the student's ability to comprehend and retain science vocabulary in order to more fully develop science concepts.

Statement of the Hypothesis:

The students will develop a greater understanding for the concepts of science contained in each unit of study through the use of flash cards for vocabulary. The students will increase the use of vocabulary in their daily classroom activities. Their lab journals will reflect an increased level of comprehension. The student's test scores for vocabulary will increase with the use of flash cards.

Limitations and Delimitations of the study:

Control Variable:

The students will all receive the same set of vocabulary terms to learn. Every student will take a pretest on the vocabulary words to determine the entry level abilities of the classes being tested. The amount of time spent in each unit of study will be the same for all groups of students.

Independent Variables:

Limitations of the study included, 1) the limited number of students that were able to participate in the study, 2) the amount of time that the students spend time outside of class time learning the vocabulary terms using the flash cards, 3) the background knowledge that the students bring to the study, 4) the amount of parental support students received at home, 5) the methods of assessments that could be used to determine improvement in scores, 6) the amount of time allowed in class to work on flash cards, 7) daily classroom attendance, and 8) the process of delivering the vocabulary terms and definitions to the students

Dependent variables:

During this study each student will receive the same list of vocabulary words to learn. The material that is being studied by this group of students will be taught the same to each group of students. The flash cards will be the only difference in the way the unit of study is taught. The amount of time each unit is taught will be the same for each group of students.

Chapter II: Literature Review

Introduction:

According to Everette Follette, EdD Professor of Science Education, Black Hills State University, problems exist within the science teaching community. There is no universal agreement on what science content or concepts should be taught. There is also no agreement as to the grade levels at which each concept should be introduced. He goes on to say that this problem is compounded when science teachers misunderstand the science vocabulary. The misuse of vocabulary between different teachers, textbooks, journal articles, and science lessons adds to the problem of student comprehension of science concepts. By misusing science vocabulary mixed messages are being sent to young students that further confuse the student's learning of science concepts.

This study reinforces the need for students to understand the necessary vocabulary contained in science curriculum. This vocabulary needs to be taught in a

manner that is universal and consistent between all areas of science. The importance that vocabulary plays towards students developing a deeper understanding, and a greater retention of science content and concepts can not be overlooked.

Teaching Vocabulary:

The Federal Reading Excellence Act was signed into law in 1998. (www.ed.gov/inits/FY99REAguidance/sectionB.html). This act set criteria for the types of instructional practices that would be supported by federal funds. This act allocated funds only for instructional practices that could be supported by “scientifically based reading research. Characteristics of scientifically based reading research includes the use of rigorous, systematic, empirical methods, the use of adequate data to test stated hypotheses and justify conclusions, observational methods that provide valid data from multiple observers and multiple observations, and acceptance by experts through a scientific review. This push for a perfect method of teaching is doomed to fail from the start. Students come into the classroom with a wide array of talents and abilities. Students all learn in different ways and it’s because they differ that one method of teaching vocabulary is inefficient. In order for educators to be the most effective in teaching reading and vocabulary skills many different approaches need to be employed. The fact that every student is unique overshadows the fact that every teacher is also an individual. For the state to mandate the methods of teaching, or the programs that can be used in teaching, creates a situation that may require teachers to teach in a way that contradicts their beliefs.

Research has shown that the most important ingredient in teaching children to read and to improve the level of reading that they can accomplish is to have them read. Increased learning is directly proportional to the increase in the volume of reading. Studies done by Allington in 1977, 1980, 1983, and 1984 and then by Allington & McGill-Frazen in 1989, (What Really matters for Struggling Readers, by Richard L. Allington), state that higher achieving readers read more than lower achieving readers. Allington goes on to state that higher achieving readers spend less time with word identification, letter sounding, and spend considerably more time discussing and responding to questions about the material. Lower achieving readers spend more time decoding text in order to make sense of the material. This causes them to read considerably less each day. Research by Nagy and Anderson in 1984 suggests that the differences in the volume of reading done in a year's time between high achieving middle grade readers and low achieving middle grade readers may be as much as 10,000,000 words per year for high achieving middle grade readers to 100,000 words per year for low achieving readers. In a correlation study on the effects of extensive reading and reading achievement by the National Assessment of Educational Progress in 1999, found that at every grade level reading more in school and at home was associated with higher reading scores. (1998 NAEP Reading Report card for the Nation, <http://nces.ed.gov/naep>) These findings were supported by Correlational studies by Mcquillan, (1998), which have produced consistent results showing positive relationships between reading activities, reading comprehension, and vocabulary development. These studies have produced consistent findings showing positive

correlations between measures of reading and measures of comprehension and vocabulary development.

Uncovering Grammar:

Pre-teaching vocabulary is a method that many teachers use to introduce units of study. The value of pre teaching is largely dependent upon the processes used to determine the important vocabulary words. The vocabulary needs to be connected to the lessons. Vocabulary that is connected to the lessons thematically is much more likely to become a part of the student's interactions both in discussions with peers and in questioning that takes place in the classroom.

One of the drawbacks to pre-teaching vocabulary is the amount of time that is required for pre teaching. Pre-teaching may or may not connect to the students cognitively so that they are more likely to be able to understand the text. An exercise that might be useful is to have the students look up the words on the vocabulary list and define them. Then using the words and the definitions they could make a prediction or a guess about what the text was going to be about. If pre-teaching is necessary because the text is difficult and you need to lessen the burden on the students it should be done as quickly as possible.

Pre-teaching is intended to pre-empt problems that might occur as students read a text, it is not intended to train readers how to cope with the problems of dealing with the text. Pre-teaching portions of the text or vocabulary reduces the stress for the student that struggles with the reading.

Teaching Vocabulary with Francie Alexander:

Three of the main reasons to teach vocabulary are 1) it improves comprehension, 2) vocabulary increases the areas of communication, listening, speaking, reading, and writing, and 3) the student's social and academic confidence and competence improves. In order to know which words are important to teach Francie Alexander breaks them into five categories.

Type A Words – These words are critical to the text. They are the academic language for content areas.

Type B Words – These are the basic words of language such as is, the, are, been, and many others.

Type C Words – Are connecting words that organize text and signal relationships

Type D Words – Difficult words, including words that have multiple meanings.

Type X Words – Words that are important to the context of the lessons but do not show up very often

The methods used to teach vocabulary need to be systematic and explicate. Direct instruction is a method of teaching selected words. Pre teaching in this manner often improves understanding and helps the student's vocabulary grow. Wide reading of text exposes students to all of the words in the text. Words in context readings, force student's to learn new words in the text through reading and discussing the text. Word studies help students take words apart to examine prefixes and suffixes. This many times allows the student to determine the origins of words.

Teaching Vocabulary with Francie Alexander: (article 2)

In order to improve student comprehension and vocabulary teachers must decide what words to teach. The list of words that are important will vary with each group of students that you are working with. The concepts that you are teaching will remain the same.

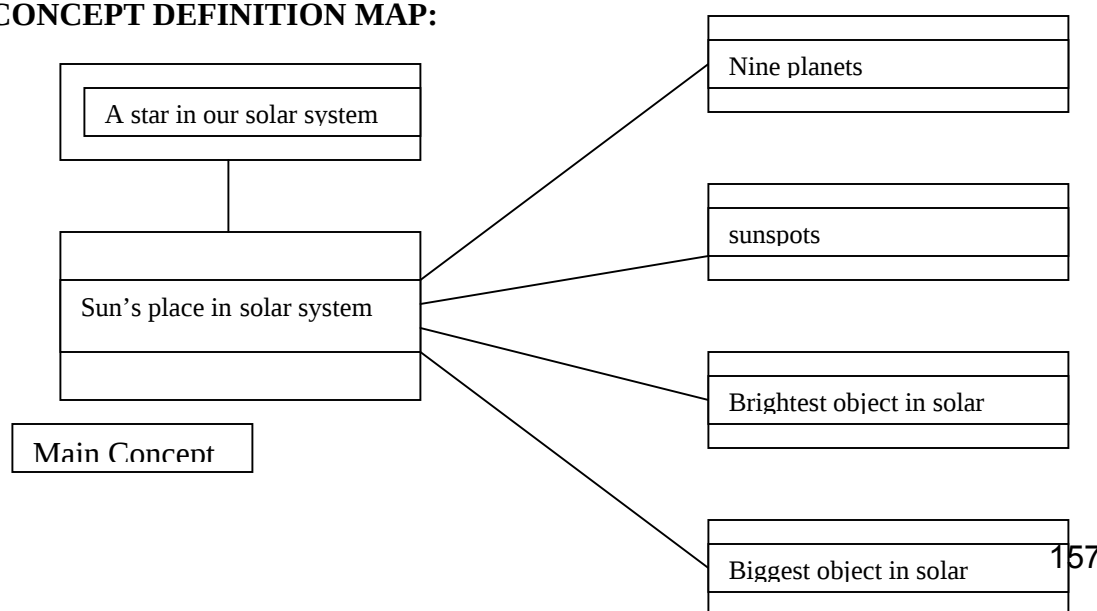
According to “Scholastic Red”, a research based professional development program that includes researchers and faculty members, Dr. Linda Diamond, Dr. Ted Hasselbring, Dr. Louisa Moats, Dr. Maryanne Wolf, teachers Laura Robb, Dr. Marilyn Whirry, Betty Tsang, and others, teaching vocabulary can be broken into three components. Part One: Owning the words and word knowledge. Part Two: What words to teach. Part Three: Model lessons, and Concept definition maps.

Part One: Owning the words and word knowledge. Research has shown that a person needs to encounter a new word at least twelve times before they know it well enough to help them comprehend written text. Many more encounters are required before this person begins to use the word in speaking and in writing. On the average a person early on in school learns between three and four thousand new words a year. This is more than twenty new words every day. Word knowledge refers to how well you understand the meaning of a word. Word knowledge can be divided into three ranges of understanding. First, unknown, the word has no meaning to the individual. Second, acquainted knowledge, the individual has a basic understanding of the word. Three, established, the individual recognizes the word automatically and understands the full meaning of the word.

Part Two: What words to teach? When teaching subject specific text such as science the students will encounter many new words. Academic language and content area words can carry most of the meaning in a selection of text. It would be difficult for students to comprehend a science textbook without learning the vocabulary for this text. Concept words and vocabulary that is unlikely to be part of the students daily language of conversation should be taught by direct instruction. One method of deciding which vocabulary words to teach involves the teacher reviewing the text and compiling a list of all the words that may be difficult for the students to understand. When this list has been compiled you need to give it to the students and have them determine which words on the list need to be taught. At this time the teacher can compile a revised list of vocabulary words. The words that are selected for vocabulary should meet the following criteria; 1) is the word important for understanding the text, 2) can the student use context to discover the meaning of the word, 3) will this word help students understanding?.

Part Three: Model Lesson: Concept Definition Map, Concept definition maps can be used to motivate and focus, set expectations, teach, and model

CONCEPT DEFINITION MAP:



Teaching Vocabulary To Advanced Students: A Lexical Approach

By Solange Moras, Sao Carlos, Brazil, July 2001

In the past the teaching of vocabulary above the elementary level has been mostly incidental. This indirect method teaching of vocabulary assumes that the vocabulary expansion will just happen through the practice of language skills. Today it is believed that vocabulary instruction should be part of class syllabus and taught in a planned manner, on a regular basis.

To teach vocabulary as a lexical approach according to Moras, the instructor needs to take into account the complexities of the language and varied forms of language, like polysemy, homonymy, synonymy, style dialect, affective meaning, translation of vocabulary, grammar of vocabulary, pronunciation, and chunks of language. In order to teach vocabulary, global concepts of what it means to understand words, are needed to give the learner opportunities to use the items learned and also develop storage systems for the material learned. Learning new items involves first short term memory and then long term memory. Retention of new items in short term memory is not effective if more than seven pieces of information are examined at one time. Word frequency is another factor that affects the storage of information. The more often an individual uses an item the easier it is to remember.

The Effects of Flashcard Use on Students' Comprehension of Chemistry Vocabulary:

In a study conducted by Feng S. Din from the University of St. Francis and Erin Wienke of the Illinois School District 212 on tenth grade chemistry students over a twelve week time period that measured the validity of flashcards to teach chemistry

vocabulary, it was found that students in the study made significantly greater gains than the control class did. This suggests that direct instruction through the use of flashcards is a valid method to improve comprehension and retention of vocabulary.

The results of this study were analyzed with the use of T tests and the results were found to be valid. T tests are used to compare groups of data against each other to prove the reliability of the data tested. A second test was also completed on the data and the results supported the results from the first test. There was a standard deviation value of less than 1 percent.

Teaching Vocabulary: (1) by Craig Weatland

Teaching vocabulary takes the approach that students will learn vocabulary quicker and retain it longer if they are allowed to have fun with the learning. By teaching vocabulary through the use of games as strategies the students will be more actively involved. Words are only useful if the individual can bring the word to mind when they need it; can use it in the correct grammatical form, pronounce it properly, spell it correctly, use it as a collocation, be aware of connotations and associations, and use it appropriately.

Vocabulary Instruction through Hypertext: Are There Advantages Over Conventional Methods of Teaching? (Teaching English as a Second or Foreign Language)

Vol. 4, No. 1, July 1999

This study breaks words into two groups; group 1, are words that have to be inferred and group 2, words that are glossed in text. This study showed a greater

retention of words that were inferred than that of words where the definition was given.

Instruction through hypertext used a computer program to measure reading levels of students and retention of new materials. The study states that students quickly become discouraged when the connection between vocabulary comprehension and vocabulary knowledge are not similar to each other. In order for students to understand a given text and be comfortable while reading this text they should be familiar with 95% of the words in the text. This often becomes a problem when students are presented with new or unfamiliar text that contains concepts and vocabulary that they are experiencing for the first time. This problem is even more pronounced in readers that are of low ability for what ever reason.

What really Matters for Struggling readers: (Designing Research-based program) by Richard L. Allington

This book provided information that was helpful in designing the methods for instituting the direct instruction strategy study on the use of flashcards to improve the comprehension and retention of vocabulary in science. The main focus of this book shows that the most important thing that can lead to improved reading and comprehension is to increase the volume of reading that is completed by the students. Reading correlation studies done by the NAEP, (National Assessment of Educational Progress) suggest that reading more everyday in school, and in homework is directly

associated with higher reading scores. What this study can not determine is whether more reading leads to better reading or does better reading lead to more reading.

Effective instruction is characterized by adaptations to the forms of instruction to best meet the needs of each individual student. In most cases curriculum materials are the same for all students regardless of the student's level of proficiency. All of the students are required to read from the same text. The key to effective classroom reading is to find materials that fit the reading levels of the students. In order to most effectively achieve this, the classroom teacher needs to have multiple resources for each lesson that they teach.

Effective teachers recognize that students are individuals and that they all have different methods of learning and vary their instruction to accommodate the greatest number of students to the highest level of learning possible.

Mosaic of Thought – Teaching Comprehension in a Reader's Workshop:

by Ellin Oliver Keene and Susan Zimmermann

In chapter seven, *A Mosaic in the Mind: Using Sensory Images to Enhance Comprehension*, the authors ask the question, are there other ways for kids to express their mental images? This chapter goes on to explore the relationship between mental images and recall of experiences. Students in this study were given a wide variety of materials that they were able to use to create images that they thought of when they read a common text. The study showed that the students' images could assess the depth of student knowledge. By learning to evoke images readers were able to recall

readings in greater detail. The study found that the more senses that a person uses the more permanent the reader can anchor a reading to their memory.

Chapter III: Methods and Procedures

Overview:

This study will examine the effects of direct instruction strategies on student comprehension and retention of science vocabulary. The students will use flash cards to learn key science concepts. The flash cards will be created by the students from a list of terms provided for them. The students will be pre tested on the key vocabulary terms before each unit of study. Then after teaching the unit a post test will be given. Improvement will be monitored. The scores of the students will be compared between the control group and the three independent variable groups. The control group will receive the terms and unit of study in the manner that the class has been taught to earlier classes. This study will be completed in at the end of teaching the Rocks and Minerals curriculum. This unit should last about four to five weeks.

Design:

This experiment consists of a control group, and three independent variable groups. The independent variable groups are the students directly involved in this study towards which this experiment was directed. The control group received the unit of study in the standard way. The students in this group will be given the list of vocabulary terms and the definitions for each of the terms. The students that make up

the independent variable groups will receive the same list of vocabulary terms as the control group students received. These groups of students will be instructed to design flashcards for each of the terms after receiving some additional instructions on the amount of detail required for each term. Two groups of the students will make flashcards that contain only the term on one side and the definition of the term on the opposite side. The last group is going to go a step beyond this in designing their flashcards. The flashcards that this group designs will have the term, a picture that represents the term, and the definition for the term. They will also write a sentence the correctly uses the term in context. I will give this group two class periods to complete their cards. A vocabulary pre test and post test will be given to each group of students and the scores will be recorded. The post test scores will be the dependent variable of the study. The change in these scores will be used to assess the validity of flash card use to learn vocabulary. I will also give a mid unit test to help determine the students comprehension of terms being used during the teaching of each daily lesson.

Selection of Subjects:

The subjects for this study belong to classes of students from Willow Creek Middle School and Kellogg Middle Schools in Rochester, Minnesota. They are eighth grade, Earth Science students. Each group will consist of approximately 23 students aged 13 to 14 years old. This is the first Earth Science class that the students have been enrolled in, so this will be the first time that the students will have the opportunity to work with these terms. Group one will be the control group for this study. Groups two and three will use one type of flashcards and group four will use

flashcards with the greatest amount of detail. The subjects in this study will all receive the same set of materials and have the same amount of time to work with these materials.

Selection of Topic:

The topic used in this study is Rocks and Minerals. The students will learn about the formation of the three types of rocks and how to classify them. They will learn to identify each type rock in a laboratory setting. The students will learn to use a variety of field tests to identify various minerals, including using Moh's Hardness Scale to identify mineral types. The use of vocabulary terms will be an important part of the laboratory experience. Each student is responsible for a journal of their laboratory experiences. It is important that the students are able to include the science terminology that coincides with the laboratory experience.

Selection of Vocabulary Terms:

- | | | |
|---------------|--------------|-------------|
| • Rock | Mineral | Luster |
| • Cleavage | Igneous | Sedimentary |
| • Metamorphic | Magma | Lava |
| • Streak | Conglomerate | Metallic |
| • Fracture | Intrusive | Extrusive |
| • Organic | Mafic | Felsic |
| • Crystal | Conchoidal | Foliated |
| • Porphyritic | Phenocryst | |

- Moh's hardness scale Inorganic

The selection of vocabulary terms comes from the text and laboratory materials that the students will have to work with during this unit of study.

Validity Measures:

The validity of this study was strong. All of the students received instruction from the same teacher. The lessons were identical for each group of students in this study. Each student received the same set of vocabulary words. The time frame of the study was the same for all of the students in the study. The variables in this study were controlled. All of the students in this study were given the same pre-test and the same post-test. The scores for each student were recorded and compared to determine the rate of improvement. A standard T test was run on all four groups of students to determine the confidence interval for each group of students. The test results showed a confidence level of greater than 95% for each group tested. A second set of T tests was conducted after the study was completed to compare pre-test scores with post-test scores to determine significant improvement rates in scores of the students in each of the three separate groups that completed this study.

Group	#	Pre-test	Post-test
Mean	1	2.43	17.78
	2	2.45	18.80
	3	2.90	17.93
	4	2.50	19.42

Deviation	1	1.90	5.74
	2	2.80	4.99
	3	3.18	5.55
	4	1.88	6.49
Confidence Level	1	95%	Standard error 1.215
	2	95%	.868
	3	95%	.765
	4	95%	1.126

The test results show that flashcards are a direct instruction technique that does show improvement in the comprehension and retention of vocabulary words in science lessons.

Reliability Measures:

The reliability measures for this study are high. The research was completed on the same group of students with the lesson taught by the same teacher in the same manner. The vocabulary words were the same for each student. The timeframe of the study was equal for all of the groups in the study. The students were pre-tested and post-tested to determine the levels of vocabulary comprehension of the students before and after completion of the unit of study. The tests were carefully monitored and presented to the students in exactly the same manner, by the same teacher.

Summary:

In summary this study has effectively shown that direct instruction through the use of flash cards has impacted an increase in the vocabulary test scores of the students in this study. Results of this study and conclusions drawn from the results of the study indicated that all students had some measure of improvement. The students that were involved in this study showed an increase in the comprehension and retention of the vocabulary words. The use of these terms in both discussions and written journals increased.

Conclusion:

This study asked if the implementation of a direct instruction technique using flash cards would improve the comprehension and retention of vocabulary terms in science. The study was further designed to determine if different types of flash cards were more effective than another type. Each group of students developed a set of flash cards. The differences in the flash cards between each group of students was the way the information was delivered to the students and in the amount of detail required of the students when designing their cards. Group one students received the vocabulary words and the definitions for each of the words. This was the control group for the study. The second and third groups of students received the vocabulary words and they had to gather the definitions by themselves. The fourth group received the vocabulary words and they were required to find the definitions for the words as well as drawing a picture on the flash card that represented the meaning of the word to them. This group of students also wrote a sentence containing the word in the proper

context for the word. The study was implemented with the whole group of students in mind. The primary focus was to have the greatest amount of impact on the lowest readers and less impact on the top readers, while helping the entire group to raise their levels of achievement. The results of this study do not support this idea. When the students were grouped according to their reading levels and then comparing the scores on the pre-tests to the scores on the post-tests what one discovers is that the students that had the highest reading level tended to have the greatest amount of improvement in post-tests scores. The lower level readers showed the least amount of improvement in post-tests scores.

This study did find a direct link between the types of flash cards that the students created and the percentage of improvement on post-test scores of the students. The greater the detail and more senses that were activated by designing and creating the flash cards the greater the amount of learning that took place. Between the four groups of this study the average scores the first three groups, group one, (the control group), and groups two and three showed less than two percent of difference. This works out to less than one correct answer for each student. The difference between the control group (group one), and group four works out to about four percent, or one and a half questions per student.

Recommendations:

Based on this study if you are going to use flash cards as a direct instruction technique you might need to modify the way the students are allowed to use the cards for studying with. In this study a variable that could not be controlled was the amount

of time that the students spent in studying the cards outside of the classroom. The students in this study were surveyed and the results of the survey found that the higher achieving students spent more time using the cards to learn their vocabulary. The lower ability students did not tend to study the flash cards outside of the classroom once they had completed the making of the cards. The results of this study might change if classroom time to study, or play games, using the flash cards was employed. This might have increased the average amount of time that each student was exposed to the flash cards.

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IMPLEMENTING MATH SKILLS GAMES INTO THE CLASSROOM
ON A DAILY BASIS WILL IMPROVE STUDENTS' PERFORMANCE ON
COMPUTATION ASSESSMENTS IN MATH

By

Mindy M. Scheel

B.S. Winona State University, 2001

A capstone paper submitted to the
Faculty of Graduate Studies of Winona State University
in partial fulfillment of the requirement for the degree of
the
Masters of Science
Department of Education

This capstone paper entitled:
Implementing math skills games into the classroom
on a daily basis will improve students' performance on
computation assessments in math.

Written by Mindy M. Scheel
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Terry Huhn

Date _____

The final capstone has been examined by the signatories,
and we find that both content and the form
meets acceptable presentation standards of scholarly work
in the above mentioned discipline.

Scheel, Mindy M. (M.S., Education, Department of Education)

Math Skills Games Will Improve Students' Performance

Capstone Paper directed by Dr. Tom Sherman

The benefit of implementing math skills games in the primary classroom was studied in a 2nd-grade classroom in southeastern Minnesota for a total of nine weeks. One class of 2nd-grade students from the 2004-2005 school year made up the control group. The experimental group consisted of the other 2nd-grade classroom of students from the 2004-2005 school year.

The control group experienced their math class in a traditional classroom environment. These students were taught their math lessons through the school system's required curriculum. Throughout the nine weeks, these students learned the same 2nd-grade math concepts as the experimental group. The experimental group was also taught their math lessons through the school system's required curriculum; however, this group was also daily actively engaged in math skills games.

At the end of each week of the nine weeks, both groups were given a timed math computation assessment in the form

of a paper and pencil test. The students were given five minutes to complete as many basic subtraction facts as possible out of one hundred. The experimental group's scores were averaged and compared to the test scores of the control group. The experimental group's scores were also found to be substantially higher than the control group's scores.

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CHAPTER I

INTRODUCTION

Need for Study

The instructor and facilitator of the study has taught in a 2nd-grade room at an elementary school in southeastern Minnesota from 2002-2005. There are two classes of 2nd-grade students. The control group contains 21 students, 100% percent Caucasian, 11 boys and 10 girls, with no students that require extensive special needs services. The experimental group contains 20 students, 100% percent Caucasian, 12 boys and 8 girls, with no students that require extensive special needs services.

The school system where I teach feels that math computation is a very critical part of academics. With the pressure from the school system to improve students' computation skills, several different methods have been implemented; however, none have shown a substantial positive change in scores. (R. Gaines, personal communication, May 15, 2004) Teachers should provide activities and experiences that develop a conceptual understanding of numbers and operations instead of focusing on memorization of rules and procedures. (Postlewait, 2003) This is what is trying to be accomplished by implementing math skills games into a rather traditional classroom setting.

Statement of the Problem

Students appear to be struggling with learning basic math facts. Despite these struggles, their computation test scores have not been improving. Learning facts does not seem to be a fun task for students. They need some motivation to help with the task.

Purpose of the Study

The purpose of the study was to improve student performance by increasing the enjoyment of learning basic math facts through playing math skills games. This was attempted by implementing various math skills games daily in the classroom. Implementing games provided enjoyment for the students while learning math facts at the same time.

Statement of the Hypothesis

The students' computation scores will be higher with the incorporation of math skills games on a daily basis than the scores of those using only the required curriculum.

Definition of Terms

- **Assessment:** A method of evaluating student performance and attainment.
- **Basic Math Facts:** A piece of information such as a statistic or a statement of the truth. For example: $9-3=6$

- Computation: The calculating of something, or the result of a calculation.
- Facilitator: Somebody who aids or assists in a process, especially by encouraging people to find their own solutions to problems or tasks.
- Math Skills Games: An activity that people participate in, together or on their own, for fun with a math concept being emphasized.
- Primary Classroom: Relating to the early years of formal education, usually for children between the ages of 6 and 12.
- Traditional Classroom: A classroom in which learning and teaching are primarily associated with content and learning methods including and related to textbook-centered lecture and instruction.

Limitations and Delimitations of the Study

The most significant limitation of this study is that the two groups studied are made up of different students. The control group was made of the students from one of the 2004-2005 second grade sections and the experimental group was made up of a different 2004-2005 second grade section. Both groups contained 20 students; the average score from

the control group was compared to the average score of the experimental group.

Another important limitation was that having two groups containing different students allows for a variety of different ability levels. There was no way of pin pointing the exact level of each second grade student in order to have two classes containing entirely equal ability levels.

The final limitations deal with the emotions of the students as well as the teacher. The attitudes of people are constantly changing. It was impossible to predict what the student's attitudes would be like as they entered into my classroom each day. It was also impossible to predict my own feelings and emotions day in and day out.

CHAPTER II

REVIEW OF RELATED LITERATURE

Computational Fluency

The development of number sense and computational fluency should be an integral part of the mathematics curriculum. Because other areas of the curriculum such as data and measurement are closely related to and sometimes dependent on these skills, students must have a firm foundation in numbers. (Postlewait, 2003) Developing computational fluency is a multifaceted task that underlies all further work with numbers. (Phillips, 2003)

Composition of a number is a basis of computational fluency. It involves learning all the parts that make up a number, for example, knowing that five is made up of two and three or four and one. Students need time to develop facility with numbers in order to solve problems and think with numbers. Children often do not develop this level of composition and decompositions as quickly as teachers assume they will. When students are forced to work with greater numbers before they can work fluently with numbers to ten, they can become dependent on rules and procedures that have no meaning. (Postlewait, 2003)

Teachers should provide meaningful activities and experiences that develop a conceptual understanding of

numbers and operations. (Postlewait, 2003) During effective instruction, students need experience with a variety of ways to solve problems and opportunities to apply some of their ideas so they can create their own understanding. (Postlewait, 2003) Computational fluency will emerge as students use flexible strategies with greater speed and accuracy. (Phillips, 2003)

Motivation

"If a man always insisted on being serious, and never allowed himself a bit of fun and relaxation, he would go mad or become unstable without knowing it."

-Herodotus (c.485-c.425 B.C.)

In order to create effective, meaningful instruction, there needs to be some fun experiences involved; and if we want students to be motivated to learn in the first place, fun must be a regular part of the classroom. Fun is a great motivator! (Erwin et al, 2004)

How better to create fun than with games? The element of fun makes games a powerful form of learning because they are intrinsically motivating. (Brandyberry, 2002) Games can provide an active, motivating way for students to review what they have already learned. Although a review of previously learned material is essential, it can be boring and unproductive if the teacher takes full responsibility

for the review. Involving students in the process can increase the effectiveness of the review and is motivating and fun for the students as well. (Wolfe et al, 2001)

Why Games

Play is nearly universal among mammals. Studies show that play stimulates the growth of synapses and through practice enables us to stabilize our learning. One definition of play is “something that is fun but purposeful”. Because it is fun, play is an intrinsically motivating activity. “Educational” games are fun but purposeful. Games, as a form of play, provide a means of practicing skills with reduced consequences. (Brandyberry, 2002)

The notion of using games to engage children in learning activities is not new. Instinctively, kids create games to help them make sense of the world around them. There is no doubt that one way to generate children’s interest in math is through their favorite activities and games. (Williamson, 2004) In connection with today’s society, most members of the younger generations are considered “masters of the game”. (Leigh, 2003) Games also benefit kids, helping them hone their analytical skills and creativity, and to learn to think “outside of the box”. (Erwin et al, 2004)

Gaming Techniques

In the book, *The Classroom of Choice*, Jonathan C. Erwin provides a great deal of information regarding the many different techniques for implementing games. Some of the most common types are physical games, mind games, and drama games.

Physical games are not just for gym class; they have a number of benefits for any classroom. First, they provide students welcome change from the “sit and git” learning approach. Second, physical games give students opportunities to practice social skills. Third, they help energize students getting blood and oxygen to their brains, preparing them physiologically for better learning when they return to their seats. Lastly, they provide students with motivation to learn!

Many students enjoy mind games just as much as physical games. Mental games help students to think outside of the box. There are many benefits for the teacher as well. Mental games require no extra space, require only materials that are already in the classroom, and show kids that thinking can be fun.

Drama games are those in which children’s imaginations are active and alive. Drama games can help exercise the

imagination and significantly enhance creativity. (Erwin et al, 2004)

When students are active participants in the learning process, not passive vessels receiving knowledge, the information being learned is much more meaningful.

(Brandyberry, 2002)

Selecting and Teaching Appropriately

As stated earlier, one definition of play is “something that is fun but purposeful”. (Brandyberry, 2002)

When an activity or game in a lesson does not have a purpose, it is simply recess. Games do not teach skills; rather, they reinforce skills and teach children how and when to use them. (Humphries, 2000)

When selecting a game it is important to ask the following questions:

1. What skills are being reinforced?
2. Is the game enjoyable for all students’ ability levels?
3. Is it an elimination game? – Remember, these games give less practice to those who oftentimes need it most.
4. Are there any social skills this game can help reinforce?

Taking the time to answer these questions will help eliminate any possible problems. Also, when trying to come up with ideas for games to reinforce a skill, remember that

some games have a lot in common and may be able to reinforce more than just one skill. When choosing a game, be sure that it reinforces something that has already been learned! (Humphries, 2000)

In order for students to learn from games, the teacher must help them focus on a specific concept, notice strategies they are using, and talk about their discoveries. (Humphries, 2000)

Lastly, routine is essential to high productivity when reinforcing skills through gaming. It is important to try to follow the same series of activities during the period of learning. (Phillips, 2003)

Math Matters

In this day and age, there are still far too many educators and parents who do not realize the importance of laying a sound foundation for mathematical thinking and computation when children are very young. If children do not get a solid foundation in pre-school through sixth grade, they are often filtered out as they enter into middle and high school. (Checkley, 1999)

Math advocates generally argue that American schools still aren't spending as much time on math or requiring as much as they ought to. (Borsuk, 2003)

It is very important to understand that competence in math can open the door to high-paid jobs, as in computer technology, for example. Our daily lives lead us to call on math for everything from understanding a tax bill to following the news to figuring out what 30% off a pair of shoes means. (Borsuk, 2003)

It's during the primary grades that children build beliefs about what it means to know and do mathematics. It is important to know that children have a natural ability to use a number system and count at this early age as well. It is at this time that math should be very positive and engaging. (Checkley, 1999)

CHAPTER III

METHODS AND PROCEDURES

Overview

The purpose of the study was to improve student performance on basic math fact timed tests by increasing the enjoyment of learning basic math facts through playing math skills games. Various games were integrated into the required curriculum. Implementing games hopefully provided enjoyment for the students while learning math facts at the same time.

The plan was to create a more positive fun environment for learning math facts. If children have the opportunity to experience fun, they will engage with full force.

Two groups of students were tested on basic math facts for a nine week period of time. During this time frame, both groups were being taught math with the required district curriculum and one of the two groups also had math skills games integrated into the lessons. Both groups of students would take a timed test each Friday for the nine week period. Each group's scores would be compiled and graphed weekly.

Once the nine weeks were complete, each group's weekly compiled scores were compared. The results showed if implementing math skills games into the already existing

curriculum was or was not effective in improving student's basic math fact computation levels.

Design

A study was conducted to show whether implementing math skills games would improve students' basic math fact computation levels. Prior to the study, the teacher was teaching math using mainly the required curriculum. The math classes consisted mostly of the teacher teaching the lesson and the students completing the corresponding worksheet. In addition, each week a timed test would be given to the students to see what each student's basic math fact computational level was. The teacher was beginning to see a trend year after year. As the year progressed the class scores would often plateau.

The teacher began to gain interest in researching new and effective ways to increase student interest in learning math facts so their scores would continue to improve throughout the entire year. Through research, the teacher considered implementing games as a new and effective way to keep students' interest and morale high when learning math facts.

Selection of Students

The students that participated in the study were all of the 2nd-grade students from the 2004-2005 school year.

These students came from two different 2nd-grade teachers. The subjects were boys and girls. The subjects ranged in achievement levels from low to high. All of the students that were in the classroom of the teacher conducting the study participated in the study.

Validity Measures

This experiment was valid because the math teacher and classroom environment for both groups remained the same. All students were required to complete the same activities within the required curriculum. Students stated they were excited for Mondays to see how each group did on the previous week's test. The teacher felt the research project was valid in exposing students to fun and engaging math skills games.

Reliability

All second graders were informed of the study. The subjects discussed why they should do their best when taking the timed fact tests. The students were scored on the test just the same as if the study were not being conducted. During the study, the tests were corrected by the teacher. The teacher supervised all students during the testing periods so each student was doing their own work and giving an honest effort.

Field Procedures

Data for the study was collected from the students on a weekly basis. A graph for each group's compiled scores was kept by the teacher. This graph was used to compare the final results of the study.

Conclusion

A design of study was chosen by the researcher, students were selected to participate in the study, validity and reliability measures were taken into consideration, and timed basic math computation tests were used to assess the students' basic fact computational levels.

CHAPTER IV

RESULTS AND DISCUSSION

Introduction

Integrating math skills based games into an established math curriculum may be a useful tool to aid in improving students' math fact computation. To test this statement two 2nd-grade classes were used for a nine-week period. Throughout this period of time the students in the experimental group were tested weekly on basic math facts while daily actively engaging in math skills games. The experimental group's scores were compared to those in the control group, which did not engage in math skills games to see which group had the higher average score.

Procedures

Two groups of 2nd-grade students participated in the study. Each group was taught math for a nine week period of time by the same teacher in the same environment. While participating in the study, students did basic math facts tests. The control group experienced their math class in a traditional classroom environment. These students were taught their math lessons through the school system's required curriculum. Throughout the nine weeks these students learned the same 2nd-grade math concepts as the experimental group. The experimental group was also taught

their math lessons through the school system's required curriculum; however, this group was also daily actively engaged in math skills games. Each student took a one hundred problem test at the end of each week. The tests were five minutes long each time. At the completion of each weekly test, the tests were collected and scored. Each group's scores were also averaged and graphed weekly to allow the students to see how they were doing, and also to help the teacher to compare the two group's scores to see if or how the games were affecting the scores.

Variables

Independent Variables:

- One group of 20 students will complete their math computation tests as normal. They will use only the required curriculum and text provided for nine weeks.
- One group of 20 students will actively engage in math skills games everyday along with the normal curriculum and text provided for nine weeks.

Dependent Variables:

- The students' test scores are dependent on the change in the daily math routine with incorporating math skills games for one group on a daily basis and not the other.

Control Variables:

- Both groups of students are in 2nd-grade starting the second semester of the year.
- Neither group has had subtraction timed tests at this point in the year.
- The test forms given to each group will be exactly the same.
- Both groups have the same amount of time to complete each test.

- All tests will be taken on the same day.
- The required curriculum will be the same for both groups.

Moderator Variables:

- Slight change in teaching methods from one group to the other.
- Parent involvement
- Absence of students
- Change in school environment (special events)

Hypothesis Testing

To test the hypothesis of the study, the researcher consulted several websites. The most informative being, <http://www.socialresearchmethods.net/kb/statdesc.htm>, this site explained the steps of hypothesis testing, including information on mean, median, and mode, the standard deviation, and t-test values. The site provided a definition of what each step was as well as a description on how to reach each of the values. Table one, found on the following page, displays the steps taken to reach a t-test value of 6.67, which proves that the hypothesis tested was in fact statistically significant.

Table 1: ***t*-Test Results**

	Control Group Scores	Experi- mental Group Scores
Mean	1052.67	1408.11
Standard Deviation	73.74	115.32
Mode	N/A	N/A
Median	1079	1434
t-test value	6.67	
Probability	.001	

These *t*-tests used a 95% confidence interval or a significance level of 0.05, a standard level used in research as the criterion for rejecting the null or no difference hypothesis. If the probability is less than or equal to this significance level, then the null hypothesis is rejected, meaning the outcome is statistically significant. If the probability is greater than the significance level then the null hypothesis is not rejected. This means that the outcome is not statistically significant and the results could be simply a matter of chance. Using these explanations, there was a statistically significant difference in the control and experimental groups' test scores.

CHAPTER V

SUMMARY AND CONCLUSION

Introduction

The study was conducted to see if integrating math skills games into an already established math curriculum would increase student test scores on basic math facts. The study was conducted using two 2nd-grade classes during a nine-week period of the school year. Each week the students were tested on their basic math facts. One hundred problems were given and students had five minutes to complete them. The scores were graphed and recorded weekly. The scores were compared weekly in order to observe any patterns or trends between the two groups.

Summary of Results

After completing the research, the experimental gaming group's average score taken from the nine weeks given was 73.68 points out of 100. The control curriculum group's average score taken from the nine weeks given was 52.92 points out of 100. This is a 20.76% higher average from the experimental group scores compared to the control group scores.

Conclusions

After compiling the data from the research, the results were found to be conclusive that the experimental

group's average scores were significantly higher than those of the control group. In the end, the teacher had a very positive outlook on implementing games into the classroom in the future.

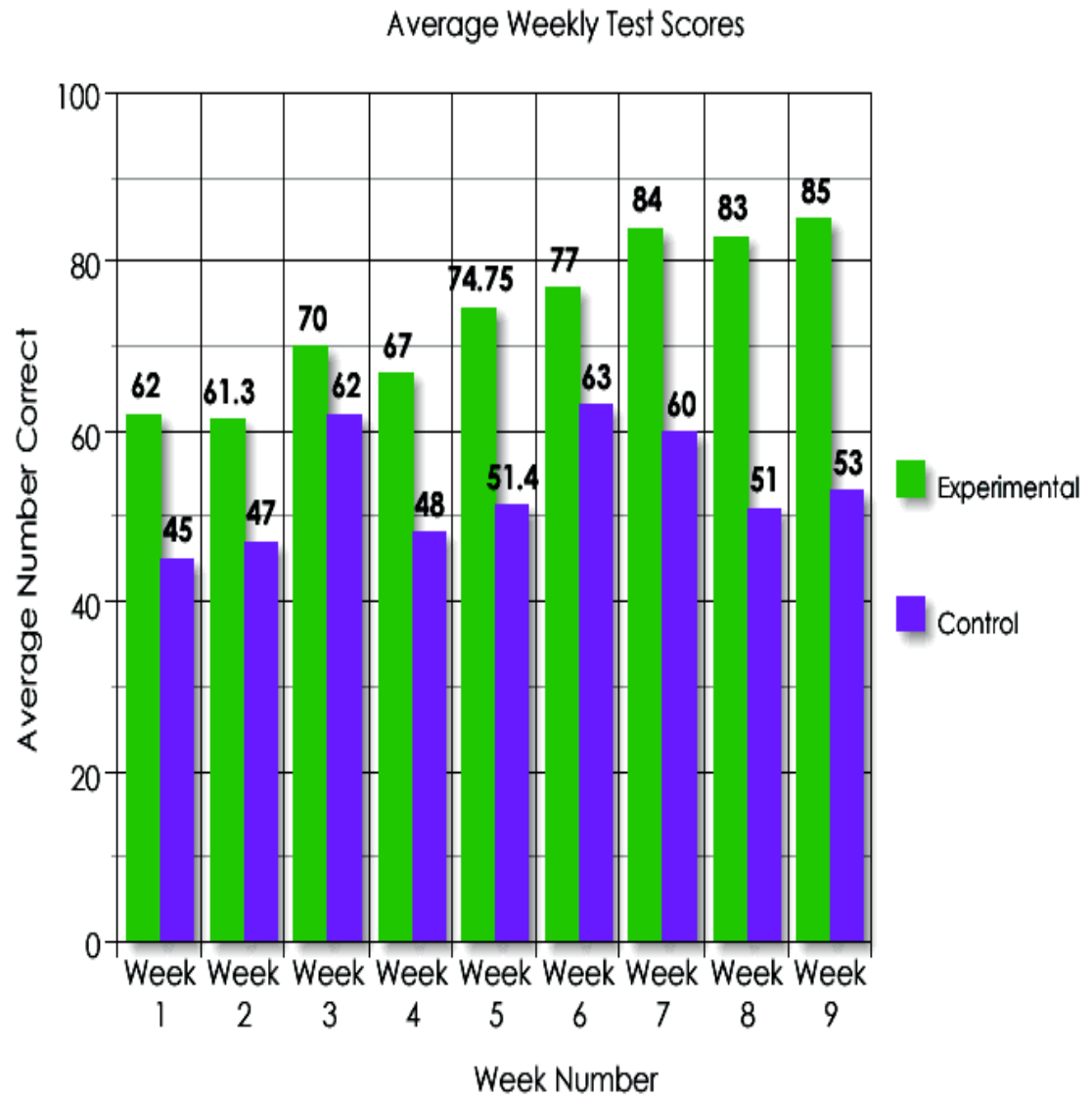
Recommendations

When the study is conducted again some adjustments could be made. Starting the test at the beginning of the year would help to get a better reading as to where the students are at without any prior school related activities. Test problems should be altered so the order of problems will change from test to test. Using this study on other math functions such as subtraction, multiplication, or division throughout the year would also help strengthen results of whether the games help to increase test scores on math facts.

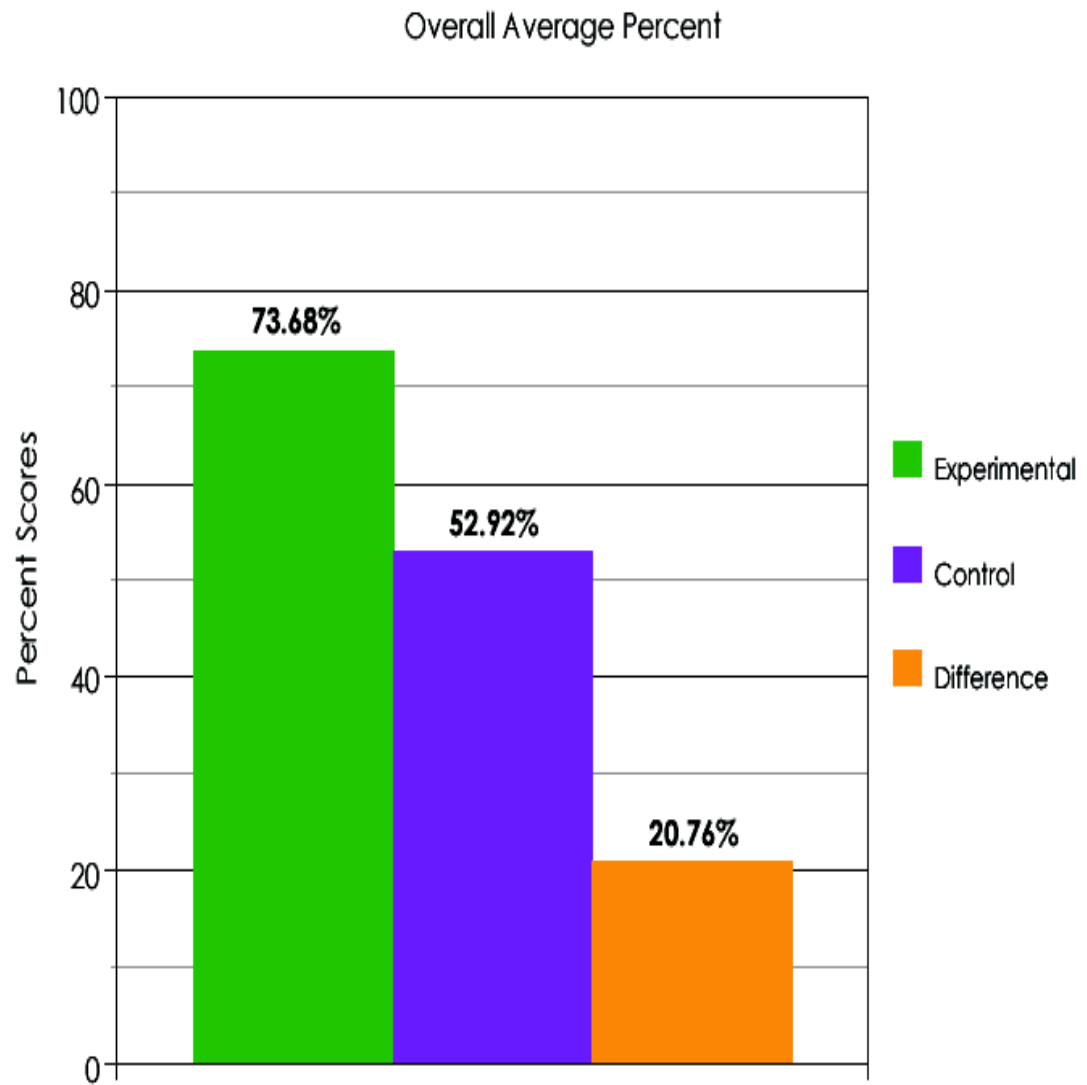
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APPENDIX A



APPENDIX B



APPENDIX C

Name _____

Time _____

Number Correct _____ /100

Subtraction • All the Facts

$\begin{array}{r} 10 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -4 \\ \hline \end{array}$
$\begin{array}{r} 5 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 15 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ -9 \\ \hline \end{array}$
$\begin{array}{r} 8 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -9 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -3 \\ \hline \end{array}$
$\begin{array}{r} 15 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -1 \\ \hline \end{array}$
$\begin{array}{r} 6 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 15 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 15 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -0 \\ \hline \end{array}$
$\begin{array}{r} 4 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -6 \\ \hline \end{array}$
$\begin{array}{r} 11 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -3 \\ \hline \end{array}$
$\begin{array}{r} 10 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -6 \\ \hline \end{array}$
$\begin{array}{r} 9 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 18 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -9 \\ \hline \end{array}$

APPENDIX D

Name _____

Time _____

(3)

Number Correct _____/100

Subtraction • All the Facts

$\begin{array}{r} 3 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -7 \\ \hline \end{array}$
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$\begin{array}{r} 3 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -6 \\ \hline \end{array}$
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$\begin{array}{r} 8 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -6 \\ \hline \end{array}$
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$\begin{array}{r} 8 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 15 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 1 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 15 \\ -8 \\ \hline \end{array}$
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$\begin{array}{r} 15 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 16 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 2 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 15 \\ -7 \\ \hline \end{array}$
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$\begin{array}{r} 10 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -6 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -8 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -6 \\ \hline \end{array}$
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$\begin{array}{r} 7 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -1 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -2 \\ \hline \end{array}$
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$\begin{array}{r} 12 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 3 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 12 \\ -3 \\ \hline \end{array}$
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$\begin{array}{r} 18 \\ -9 \\ \hline \end{array}$	$\begin{array}{r} 6 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 13 \\ -5 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 8 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -9 \\ \hline \end{array}$
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$\begin{array}{r} 4 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 14 \\ -7 \\ \hline \end{array}$	$\begin{array}{r} 10 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 9 \\ -3 \\ \hline \end{array}$	$\begin{array}{r} 7 \\ -2 \\ \hline \end{array}$	$\begin{array}{r} 5 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 4 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 11 \\ -4 \\ \hline \end{array}$	$\begin{array}{r} 0 \\ -0 \\ \hline \end{array}$	$\begin{array}{r} 17 \\ -8 \\ \hline \end{array}$
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